

**Report from the Tobacco-Related Disease Research Program
to the California Legislature: 2010–2015**

December 2015

**Tobacco-Related Disease Research Program
Annual Report to the State of California Legislature 2015**

Report prepared by the University of California, Office of the President pursuant to Article 2 of Chapter 1 of Part 3 of Division 103 of the California Health and Safety Code

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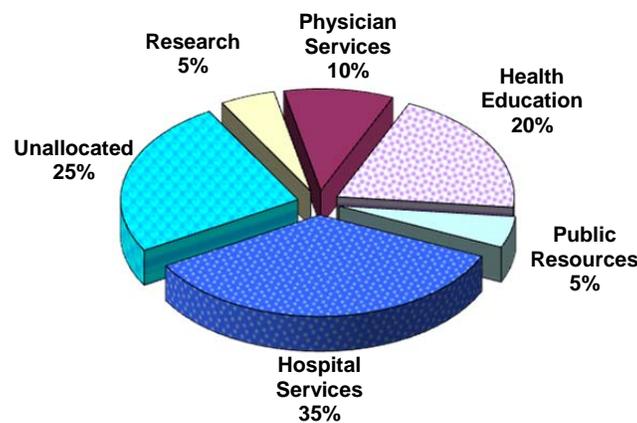
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Executive Summary

Twenty-seven years ago, California voters passed Proposition 99, the California Tobacco Health Protection Act of 1988, which instituted a 25¢ per pack cigarette surtax, with the revenues reserved for programs designed to reduce tobacco use and support tobacco-related research. This tax allowed California to become the first model for a comprehensive state tobacco control program aimed at de-normalizing the use of tobacco products.

The Cigarette and Tobacco Products Surtax Fund consists of six accounts in which specific percentages of the revenue collected through the Tobacco Health Protection Act of 1988 are deposited annually (Figure 1).

Figure 1. Distribution of Tobacco Tax Revenue Specified by Proposition 99



Five percent of the funds are placed in a research account used to fund research on the prevention and treatment of tobacco-related diseases in California. This includes research in biomedical sciences, nicotine dependence, epidemiology, social behavioral science and policy.

Per legislative mandate, the University of California administers the revenues from the research account. The Tobacco-Related Disease Research Program (TRDRP) was established by the University to oversee and coordinate the research program.

The TRDRP is a leader in California's efforts to reduce the human and economic costs of tobacco use through innovative research and information dissemination. The TRDRP:

- supports outstanding research that facilitates the elimination of smoking and tobacco use and mitigates the human and economic costs of tobacco use in California;
- widely disseminates research findings through a variety of media;
- encourages and supports new scientific infrastructure and networks critical for a comprehensive approach to tobacco control; and
- serves as an information resource for those interested in current research on tobacco control and tobacco-related disease.

The TRDRP is recognized by the National Cancer Institute as a funding agency that meets its high standards for peer review and selection of award recipients. In making grant determinations, the TRDRP employs multiple levels of scientific review of submitted proposals. This ensures TRDRP selectively and strategically invests in research that:

- addresses particularly challenging or underfunded areas;
- is potentially groundbreaking; and
- targets emerging tobacco-related issues of particular significance to California.

Required Reporting Elements

This report has been prepared by the University of California, pursuant to California Health and Safety Code, Section 104500(c). The following required reporting elements are addressed in this report:

1. The number and total dollar amounts of funded and pending research grants, including the amount allocated to indirect costs.

From July 1, 2010, through June 30, 2015, the TRDRP awarded nearly \$57 million for 210 research projects. As of July 1, 2015, TRDRP approved nearly \$10 million in funding for 31 new grants. Information about the grants awarded in each of research priority area and by fiscal year is shown in Tables 1 and 2.

Table 1: Research Projects Funded from July 1, 2010 to June 30, 2015 by Priority Area

PRIORITY AREA	NUMBER OF PROJECTS FUNDED	AMOUNT FUNDED	PERCENT OF DOLLARS FUNDED
Disparities, Prevention, Cessation and Nicotine Dependence	74	\$17,078,153	30%
Early Diagnosis/Pathogenesis	75	\$19,089,932	34%
Environmental Exposure and Toxicology	28	\$11,308,160	20%
Industry Influence /Policy	26	\$6,734,693	12%
Regulatory Science/New Products	7	\$2,036,171	4%
Totals	210	\$56,247,109	100%

Table 2: Project Funding Costs 2010 – 2015, by Fiscal Year

FISCAL YEAR	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	5-YEAR SUMMARY	PENDING GRANTS*
Grant Cycle**	19	20	21	22	23		24
CORE GRANTS AWARDED***	51	44	38	40	29	202	31
<i>Direct Costs</i>	\$9,950,242	\$8,316,747	\$8,111,091	\$7,487,736	\$5,516,074	\$39,381,890	\$7,527,610
<i>Indirect Costs</i>	\$2,601,024	\$1,331,019	\$2,133,732	\$2,383,157	\$1,911,947	\$10,360,879	\$2,417,137
<i>Total Grant Costs</i>	\$12,551,266	\$9,647,766	\$10,244,823	\$9,870,893	\$7,428,021	\$49,742,769	\$9,944,747
SPECIAL INITIATIVES AWARDED	2	4	1	0	1	8	0
<i>Direct Costs</i>	\$150,00	\$3,641,983	\$459,900	-	\$2,057,413	\$6,309,296	-
<i>Indirect Costs</i>	\$0	\$2,457	\$0	-	\$192,587	\$195,044	-
<i>Total Initiative Costs</i>	\$150,000	\$3,644,440	\$459,900	-	\$2,250,000	\$6,504,340	-
TOTAL PROJECTS FUNDED	53	48	39	40	30	210	31
<i>Total Direct Costs</i>	\$10,100,242	\$11,958,730	\$8,570,991	\$7,487,736	\$7,573,487	\$45,691,186	\$7,527,610
<i>Total Indirect Costs</i>	\$2,601,024	\$1,333,476	\$2,133,732	\$2,383,157	\$2,104,534	\$10,555,923	\$2,417,137
<i>Total Funds Disbursed</i>	\$12,701,266	\$13,292,206	\$10,704,723	\$9,870,893	\$9,678,021	\$56,247,109	\$9,944,747

* Funding decisions made before 7/1/2015

** Refers to the cohort of grants that were funded in the indicated fiscal year

*** Includes single-investigator grants and collaborative community-based participatory research grants

2. Lists of funded grants, including investigators, institutions, project titles and total funds awarded.

Section III of the report includes descriptions of a selection of grants. Appendix II provides a list of all grants awarded during the period covered by this report. To date, TRDRP has overseen 24 annual grant cycles and funded more than 1500 research grants to investigators who have advanced the tobacco-related disease and biomedical research field, informed innovative evidence-based policies and tobacco control efforts, or addressed the health and economic consequences of tobacco use. This research has ranged from explaining the toxicity of nicotine and other smoking-related constituents to identifying biomarkers that could be clinically useful for the early diagnosis and molecular characterization of tobacco-related cancer, lung disease and cardiovascular disease.

TRDRP-funded projects have also provided data researchers could use to leverage additional funding from federal agencies and other foundations. This resulted in a return on investment (leverage) of approximately \$3 per \$1 of TRDRP support.

That leveraged funding, in turn, provided these researchers expanded opportunities to:

- address emerging scientific questions;
- confront health disparities associated with smoking;
- assess the ongoing economic and public health costs that are the result of tobacco use; and
- inform policies for and practice of tobacco control in California.

3. Program accomplishments.

From 2010-2015, TRDRP solicited proposals for both investigator-initiated research, in which the researchers propose the topic, and special research initiatives in targeted areas identified by the TRDRP through a strategic planning process. Below are descriptions of the impact TRDRP-funded projects have had on tobacco control and tobacco-related disease in California. Additional information can be found in Section I of this report.

Investigator-initiated Research

By inviting investigator-initiated research in underfunded and emerging areas, TRDRP harnessed the most innovative ideas and approaches from the broadest range of disciplines to achieve its strategic goals. TRDRP-funded research has led to advances in biomedical research in tobacco-related diseases, development and evaluation of cessation interventions, more informed tobacco control policies at the state and local level, and sustained growth in the workforce of researchers in the tobacco field.

A study conducted at Lawrence Berkeley National Laboratory that investigated whether cigarette smoke impairs an important protective mechanism in HDL-cholesterol that fights against the development of heart disease is one example of impactful biomedical research TRDRP funds. Medical doctors can use the findings from this study to help patients who smoke better understand the dangers of smoking and the therapeutic benefits of quitting.

By funding investigator-initiated research in underfunded and emerging areas, TRDRP harnesses the most innovative ideas and approaches from the broadest range of disciplines to achieve its strategic goals.

Innovative TRDRP-funded research on the basic neuroscience of nicotine addiction and treatment has also been instrumental in filling significant knowledge gaps. For example, a TRDRP-funded study conducted by researchers at UC Irvine and published August 15, 2015, in the *Journal of Physiology* concluded that nicotine exposure, increasingly occurring as a result of e-cigarette use, may induce changes that sensitize the adolescent brain to other drugs and prime it for future substance abuse.¹

¹ Yuan, M., Cross, S. J., Loughlin, S. E. and Leslie, F. M. (2015), Nicotine and the adolescent brain. *The Journal of Physiology*, 593: 3397–3412.

TRDRP also funds research that can be used to inform policy at the state and local level. This research included a UCSF study of the cost of smoking for California's 58 counties that showed 4,174 fewer Californians would die if tobacco taxes were increased. TRDRP funded research from the same group determined that in 2009 the economic burden of smoking in the state amounted to \$18.1 billion.

Research projects such as these have contributed to California's phenomenally successful smoking prevention and cessation efforts, which have cut the state's smoking rates in half and reduced its lung cancer rates three times faster than the rest of the country. This success, however, is offset by California's large population. The state has the highest total number of smokers — 3.9 million, including 146,000 adolescents — and continues to lead the nation in the number of lung cancer deaths.

Moreover, not all communities within California are impacted equally by tobacco. Studies show that smoking prevalence (the proportion of the population smoking) and lung cancer incidence (the rate at which the disease occurs in a population) are significantly higher among individuals who live below the poverty line and have minimal education. There are also differences across race and ethnic groups. Addressing tobacco use in California will require developing programs that address the disproportionate rates of tobacco use seen in these populations. For example, a TRDRP-funded study conducted by Janice Tsoh, Ph.D., Associate Professor of Psychiatry, UC San Francisco, has shown promise using culturally-concordant lay health workers to help Vietnamese-American males to quit smoking. This research is one example of TRDRP's efforts to develop interventions for California populations whose smoking rates continue to be higher than other groups.

TRDRP also invests in the career development of young investigators performing research in tobacco-related fields in order to ensure that California has the capacity to address future issues in tobacco control. In 2014, we evaluated the return on investment of career development awards funded between 2005 and 2014. The evaluation showed that during this time period TRDRP invested \$22 million in new tobacco researchers through 54 awards to graduate students, 89 awards to postdoctoral fellows, and 41 awards to new faculty members. A review of 94 of these awards found that each grant advanced the research field with, on average, three publications. TRDRP funding was also a clear stepping stone for additional funding, with these 94 awards leading to an additional \$33,103,417 from other funders. The review also found many of the researchers who received TRDRP funding continued to stay in the tobacco field, with rates ranging from 34 percent to 73 percent, depending on award type.

TRDRP provides support for young investigators, as part of its commitment to the training and development of a new generation of tobacco-control and tobacco-related disease researchers.

Special Research Initiatives

Cognizant of changes in the tobacco industry and tobacco control environment, the TRDRP initiated an extensive planning process in 2010 to transform both its funding priorities and the corresponding funding mechanisms.

This planning process prepared TRDRP to address new challenges and move the research field forward in unique ways. Importantly, it resulted in the development of three special research initiatives that strategically advanced research on:

- thirdhand smoke,
- the early detection of lung cancer, and
- the economic and social impact of policies aimed at curbing tobacco use and decreasing tobacco-related disease.

Thirdhand Smoke Initiative

Toxic compounds have been identified in thirdhand smoke, the residual tobacco smoke pollutants that remain on surfaces and in dust after tobacco has been smoked, are re-emitted back into the gas phase, or react with oxidants and other compounds in the environment to yield secondary pollutants. The California Consortium on Thirdhand Tobacco Smoke brought together investigators from a broad range of disciplines from across California with strong research backgrounds in the characterization, exposure, and health effects of tobacco smoke to:

- identify and examine new chemicals that form from secondhand smoke and thirdhand smoke when they age on indoor surfaces;
- develop new ways to measure human exposure to thirdhand smoke in house dust, on surfaces, and in people who are exposed to tobacco smoke;
- learn how chemicals in thirdhand smoke cause genetic damage and affect the reproductive system; and
- develop risk assessment models and projections of health care costs related to thirdhand smoke.

The TRDRP Thirdhand Smoke Initiative informed the passage of California legislative bill AB 1819. The bill, which went into effect in January 2015, prohibits smoking tobacco at all times in licensed family childcare homes and in areas where children are present.

This work resulted in 21 published scientific articles (Appendix III). It also informed state and federal policy decisions, including California legislative bill AB 1819. This law went into effect in January 2015 and prohibits the smoking of tobacco at all times in licensed family childcare homes and in areas where children are present. As this legislation was being discussed, relevant research findings published by the Consortium were widely disseminated through widespread media coverage (Appendix IV).

At the federal level, research from the Thirdhand Smoke Consortium informed the call for research the U.S. Department of Housing and Urban Development (HUD) Office of Lead Hazard Control and Healthy Homes released in June 2015 for the Healthy Homes Technical Studies Grant Program. Through this program, HUD will award an estimated \$2 million to advance the recognition and control of priority residential health and safety hazards and more closely examine the link between housing and health.

Lung Cancer Early Detection Initiative

In 2011, the TRDRP awarded grants to support two translational research projects at UC Davis and UCLA, involving collaborations between laboratory researchers and clinicians, aimed at developing non-invasive, cost-effective methods for early lung cancer detection. The TRDRP also funded eight other projects under this initiative. This major investment in transformative research was made to fill a pronounced funding gap for early detection research that was identified during the 2010 planning process. The two translational projects funded were:

- Salivary Biomarkers Development for Detection of Lung Cancer
This project aimed to identify a panel of biological markers (biomarkers) found in saliva that could be used for the early detection of lung cancer. This research resulted in six publications (Appendix V). It also led to the development of a new technology called Electric Field-Induced Release and Measurement (EFIRM), a method for performing a liquid biopsy of saliva or blood that has the potential to revolutionize cancer detection and treatment.
- Integrated Multi-omics Approach to Detect Early Lung Cancer
This project was led by internationally recognized lung cancer researchers and clinicians at UC Davis who are leaders in a new specialized field that uses sophisticated tools to study a broad range of substances, such as sugars (glycomics), fats (lipidomics) and chemicals (metabolomics), that can be used for cancer screening and detection. The project aims to identify specific sugars, fats and chemicals that can be used for lung cancer screening and early detection. Findings from this translational research grant resulted in two publications; a third manuscript is under review (Appendix V). These papers describe two research milestones: The identification of chemicals in blood that correlate with the type of cancer found in the lungs and the largest ever evaluation of chemicals and sugars in cancerous and healthy tissue.

Rapid Policy Research Initiative

Following a competitive peer-review process, the TRDRP Rapid Policy Research Initiative provided funding for three research teams to quickly conduct and publish research on the economic impact of smoking and the contribution of cigarette taxes — two pressing tobacco control related policy issues facing California.

- The first team estimated the effect of the California Tobacco Control Program on state health care costs, the number of cigarette packs not smoked (not sold) and the cost to the tobacco industry. They also projected what is likely to happen over the next three years to smoking and health care costs if the level of funding for tobacco control is maintained, increases, or decreases. This work resulted in the research publication “The Effect of the California Tobacco Control Program on Smoking Prevalence, Cigarette Consumption, and Healthcare Costs: 1989–2008” in *PLoS One*.²
- The second team used a dynamic model to evaluate the economic impact of California’s Tobacco Control Program under different scenarios. This allowed the researchers to assess the economic impact alternative tobacco control policies would have on specific populations. This work

² Lightwood J, Glantz SA (2013) The Effect of the California Tobacco Control Program on Smoking Prevalence, Cigarette Consumption, and Healthcare Costs: 1989–2008. *PLoS ONE* 8(2): e47145.

resulted in two research publications: “Evaluation of the economic impact of California’s Tobacco Control program: a dynamic model approach,” in *Tobacco Control* and “The Disproportionate Cost of Smoking for African-Americans in California, in the *American Journal of Public Health*.³⁴

- The third team evaluated per capita consumption differences between California and other U.S. states. They investigated whether per capita consumption trends from 1960 through 2002 were explained by differences in cigarette price and tobacco control expenditure. They also determined when the per capita consumption decrease occurred that resulted in California lung cancer rates dipping below the rest of the nation in 1992. Their research paper, “Forty Years of Faster Decline in Cigarette Smoking in California Explains Current Lower Lung Cancer Rates” was published in *Cancer Epidemiology, Biomarkers & Prevention*.⁵

4. Future Directions.

During the time period covered by this report, the TRDRP met with its Scientific Advisory Committee (Appendix I) on a quarterly basis to receive guidance on the direction and priorities of the program. The Scientific Advisory Committee is the primary advisory board for the TRDRP. Members represent research institutions from throughout California involved in tobacco-related disease research and major California organizations involved in tobacco control efforts. Current members, for example, are affiliated with the University of Southern California, San Diego State University, several University of California campuses, the American Heart Association, the American Cancer Society, the American Lung Association of California, the California Department of Education, the Lung Cancer Alliance and the California Department of Public Health.

In 2014, the TRDRP engaged its Scientific Advisory Committee and a strong network of stakeholders in a strategic planning process to determine future research directions for the program. Committed to maintaining a leadership role in this arena, TRDRP determined it would further strengthen the program’s effectiveness by prioritizing:

- research with highest potential for impact,
- research advancing engagement with communities throughout California,
- support for developing new leadership in tobacco-related research, and
- research initiatives targeted at new and emerging challenges in the tobacco landscape.

Details about a similar strategic planning process from 2010 that resulted in the investigator-initiated projects and strategic research initiatives that are described in this report can be found in Section II. A broader description of the outcome of the 2014 planning process is provided in Section V.

³ Miller LS, Max W, Sung HY, et al. Evaluation of the economic impact of California's Tobacco Control Program: a dynamic model approach *Tobacco Control* 2010;19:Suppl 1 i68-i76 .

⁴ Max W, Sung HY, Tucker LY, Stark B. The disproportionate cost of smoking for African Americans in California. *American Journal of Public Health*. 2010 Jan;100(1):152-8.

⁵ Pierce JP, Messer, K et al. Forty Years of Faster Decline in Cigarette Smoking in California Explains Current Lower Lung Cancer Rates, *Cancer Epidemiology Biomarkers Prevention* November 2010 19:2801-2810; Published Online First Sept. 17, 2010.

The program and its Scientific Advisory Committee anticipate that these new emphases and initiatives will have broad impact on the field in the years to come and look forward to reporting on its progress in the 2020 Legislative Report.

TRDRP Financial Tables

TRDRP funds high-quality, innovative research that will advance knowledge needed to improve tobacco control and the prevention and treatment of tobacco-related diseases. The proposition 99 income that made these grants possible is shown in Table 3, while Table 4 details the operational expenses incurred.

Table 3: TRDRP Proposition 99 Income, 2010 - 2015

FISCAL YEAR	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	5-YEAR SUMMARY
Total Proposition 99 Allocation	\$12,534,000	\$12,681,000	\$11,115,000	\$11,249,000	\$10,128,000	\$57,707,000

Table 4: Expenditures for Administration and Program Support, 2010 - 2015

FISCAL YEAR	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	5 YEAR SUMMARY
Grant Cycle*	19	20	21	22	23	
Administration	\$442,406	\$400,782	\$421,954	\$446,543	\$553,125	\$2,264,811
% Total Funds	3%	3%	4%	4%	5%	4%
Research Support, Evaluation & Communications	\$739,314	\$1,036,729	\$995,766	\$1,064,486	\$1,161,872	\$4,998,168
% Total Funds	6%	8%	9%	9%	11%	9%

* Refers to the cohort of grants that were funded in the indicated fiscal year

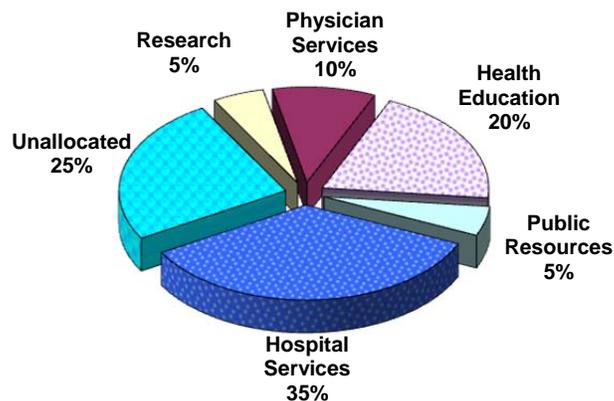
I. Impact of the Tobacco-Related Disease Research Program in California

Origin and Mission of the Tobacco-Related Disease Research Program

Twenty-seven years ago, California voters passed Proposition 99, the California Tobacco Health Protection Act of 1988, which instituted a 25¢ per pack cigarette surtax, with the revenues reserved for programs designed to reduce tobacco use and support tobacco-related research. This tax allowed California to become the first model for a comprehensive state tobacco control program aimed at de-normalizing the use of tobacco products.

The Cigarette and Tobacco Products Surtax Fund consists of six accounts in which specific percentages of the revenue collected through the Tobacco Health Protection Act of 1988 are deposited annually (Figure 1). Five percent of the funds are placed in a research account used to fund research on the prevention and treatment of tobacco-related diseases in California. This includes research in biomedical sciences, nicotine dependence, epidemiology, social behavioral science and policy.

Figure 1. Distribution of Tobacco Tax Revenue Specified by Proposition 99



Proposition 99 mandated the creation of a Tobacco Education and Research Oversight Committee (TEROC) to lead and oversee tobacco prevention efforts in California funded by the surtax. Three state agencies receive funding to carry out these efforts:

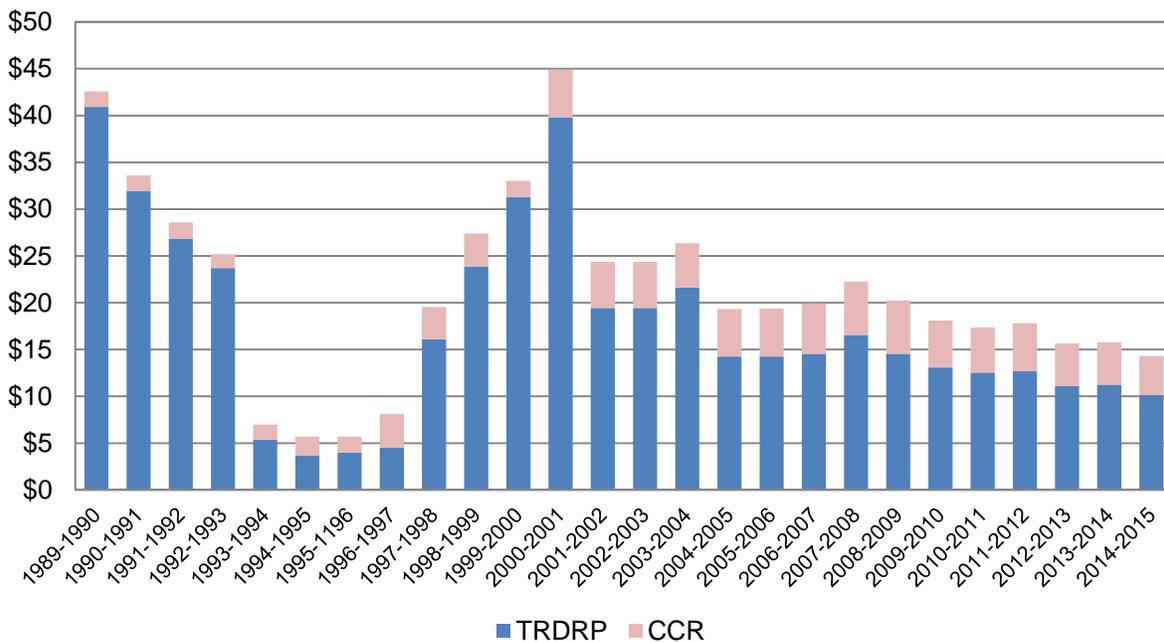
- California Department of Public Health, which directs its efforts through its California Tobacco Control Program;
- California Department of Education, which instituted a Tobacco-Use Prevention Education Program; and
- University of California Office of the President, which houses the TRDRP within its Research Grants Program Office in Oakland.

Per legislative mandate, the revenues from the research account are administered by the University of California. The University established the TRDRP to oversee and coordinate the research program. Our aim is to reduce the human and economic costs of tobacco use through innovative research and information dissemination.

Evolution of Tobacco Products and Advances in Science: Challenges in the 21st Century

During the period covered by this report (2010–2015), changes in the tobacco industry and tobacco control environment presented several challenges for the state and this funding program. Inflation took a toll on the purchasing power of funds directed for tobacco-related disease research as did the reduction in smoking rates in California (which should be applauded). Although not originally intended for this purpose, Proposition 99 research funds have also continued to be allocated for use by the California Department of Public Health’s Cancer Registry (Figure 2). Identifying another appropriate source of support for Cancer Registry activities would restore resources for competitively funded tobacco-related disease research by \$4.5 million (a 40 percent increase) compared to 2014-2015 funding levels.⁶

Figure 2: Allocation of Proposition 99 Research Account Appropriations to TRDRP and Cancer Control Registry, 1989–2015 (millions)

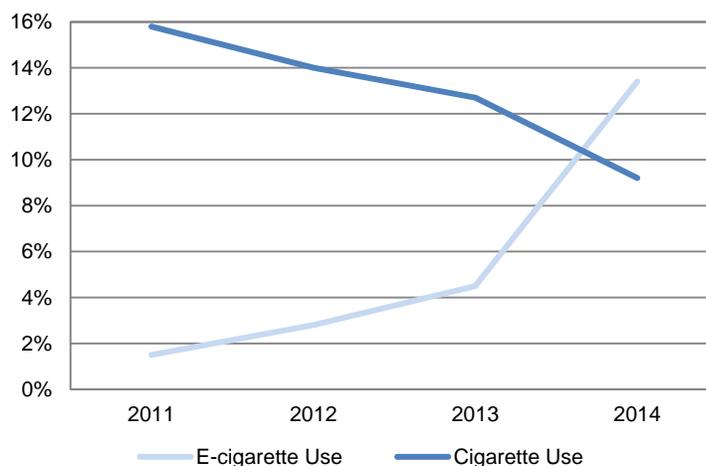


During the time period covered by this report, there has also been a decline in funding from the National Institutes of Health for biomedical research in general, and lung cancer research in particular. This directly impacted investigators and increased the number of researchers who sought support from TRDRP. This time period also saw an increased focus in pharmacologic and biotechnical research into targeted cancer therapies. The new therapies have extended the lives of some individuals with cancer, including lung cancer. Unfortunately, they also created an environment in which there was less incentive and fewer dollars for research on lung cancer early detection, an approach with the potential to extend survival rates. This development also pushed more investigators to turn to TRDRP for funding for their work.

⁶ Cox E, Barry R, Glantz S, Barnes R. Tobacco Control in California, 2007-2014: A Resurgent Tobacco Industry While Inflation Erodes the California Tobacco Control Program. Center for Tobacco Control Research and Education. UCSF. 2014. escholarship.org/uc/item/4jj1v7tv.

On the policy front, the U.S. Food and Drug Administration (FDA) entered into tobacco regulation as part of the 2009 Family Smoking Prevention and Tobacco Control Act, which created a need for more evidence-based research to support its efforts. TRDRP also saw the rapid introduction of e-cigarettes and other electronic nicotine delivery systems (ENDS), which required research to help legislators develop policies to address these new tobacco products. Data from the U.S. Centers for Disease Control and Prevention showed e-cigarette use tripled among U.S. high school students from 2011–2014 (Figure 3).

Figure 3. E-Cigarette Use Triples Among U.S. High School Students, 2011–2014



Source:
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6414a3.htm?s_cid=mm6414a3

This increase was driven in large part by the tobacco and e-cigarette industries, which heavily marketed these unregulated products to youth and young adults to create a perception that this new form of smoking was cutting edge, safe and cool. The industries’ efforts directly challenged the progress successful tobacco control programs had made in changing norms related to smoking. For example, a study in the August 18, 2015, *Journal of the American Medical Association* investigating e-cigarette use among 14-year-olds at 10 public high schools found that those who had used e-cigarettes were more likely than nonusers to begin smoking regular cigarettes.⁷

The failure of the FDA and others to comprehensively regulate sales, marketing and distribution of tobacco-related products, including e-cigarettes, posed — and continues to pose — additional problems. At the state level, efforts to increase California’s cigarette tax, the 33rd lowest in the nation, persist. Meanwhile, the onslaught of spending by the tobacco industry and related interest groups to challenge and counteract California’s efforts to create a tobacco-free state continued full speed. From 2007 through 2014, the tobacco industry dominated tobacco control policymaking in California, spending more than \$64.4 million on state-level political activity. In 2012, the tobacco industry and its allies spent \$47.7 million — five times the amount spent by health advocates — to defeat Proposition 29, an initiative that would have increased the cigarette excise tax by \$1 per pack for medical research and helped to reinvigorate the California Tobacco Control Program.

In the face of these challenges, the state continued to see a decline in tobacco use. California’s smoking rates decreased from 23.7 percent in 1988, when Proposition 99 was passed, to 11.7 percent in 2013 — a 51 percent decline.⁸ High school smoking rates declined by 51 percent from 2005–2012.⁹ In addition, from 1999–2010, lung cancer rates decreased three times faster in California than the rest of the U.S.⁹

⁷ Leventhal AM, Strong DR, Kirkpatrick MG, et al. Association of Electronic Cigarette Use With Initiation of Combustible Tobacco Product Smoking in Early Adolescence. *JAMA*. 2015;314(7):700-707.

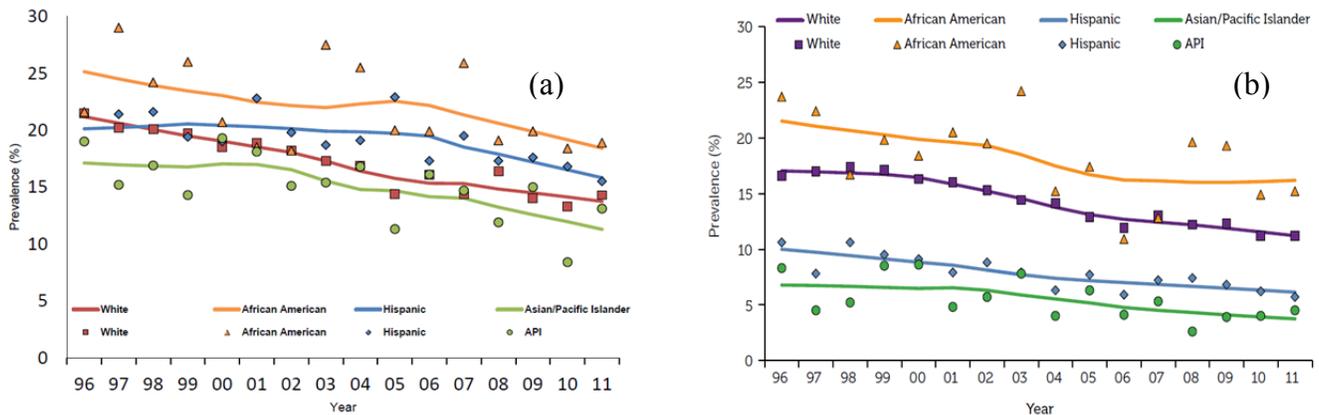
⁸California Department of Public Health, California Tobacco Control Program, California Tobacco Facts and Figures 2015, Sacramento, CA, 2015.

This success, however, is offset by California’s large population. The state has the highest total number of smokers — 3.9 million, including 146,000 adolescents — and continues to lead the nation in the number of lung cancer deaths.

To bring the state’s smoking rates down further requires developing programs that address the disproportionate rates of tobacco use seen in specific populations. Smoking prevalence (the proportion of the population smoking) in California is significantly higher among individuals who live below the poverty line and have minimal education. There are also differences across race and ethnic groups.

As the report *California Tobacco Facts and Figures 2015* shows, African Americans — both male and female — smoke more than other race/ethnic groups.¹⁰ A lower prevalence is seen among Hispanic and Asian/Pacific Islander women; however, smoking prevalence is more than two times as high among their male counterparts, with Hispanic males smoking more than White males (Figures 4(a) and 4(b)).

Figure 4: CA Smoking Prevalence by Ethnicity Among (a) Men and (b) Women for 1996-2011



Source: Behavioral Risk Factor Surveillance System/California Adult Tobacco Survey (BRFSS/CATS) 1996-2011. The data are weighted to the 2000 California population. Note: The smooth lines are based on a model to smooth out the data. The National Health Interview Survey was not conducted in 1996. The rates were averaged for 1995 and 1997 to estimate the 1996 rates. California Department of Public Health, California Tobacco Control Program, California Tobacco Facts and Figures 2015, Sacramento, CA, 2015.

Research is needed to determine the best ways to reduce tobacco use among these specific populations. For example, a TRDRP-funded study conducted by Janice Tsoh, Ph.D., Associate Professor of Psychiatry, UC San Francisco, has shown promise using culturally-concordant lay health workers to help Vietnamese-American males to quit smoking. This study is one example of our efforts to develop interventions for California populations whose smoking rates continue to be higher than other groups.

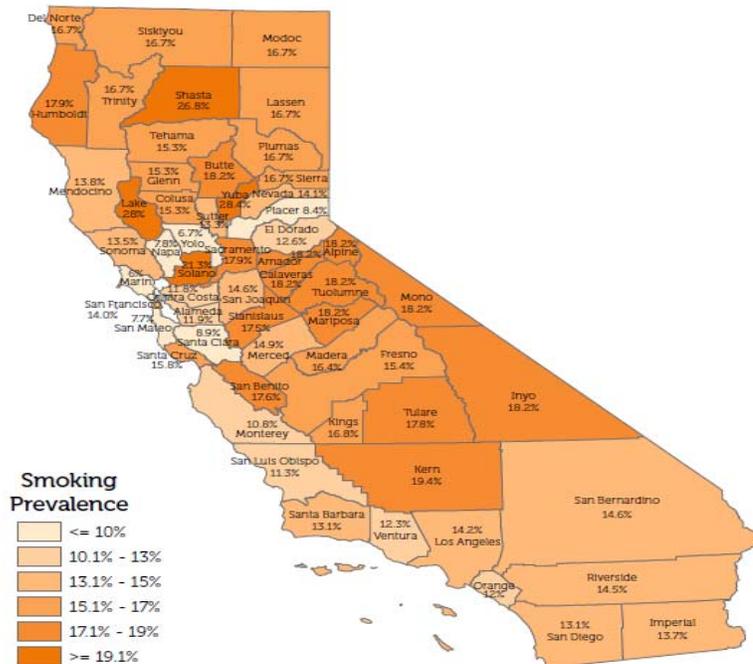
⁹ Tobacco Education and Research Oversight Committee. Changing Landscape: Countering New Threats, 2015-2017. Toward a Tobacco-Free California Master Plan. Sacramento, CA: Tobacco Education and Research Oversight Committee. 2014. cdph.ca.gov/services/boards/teroc.

¹⁰ California Department of Public Health, California Tobacco Control Program, California Tobacco Facts and Figures 2015, Sacramento, CA, 2015.

Lesbian, gay, bisexual and transgender adults and youth also smoke at substantially higher rates than the general population.

Smoking prevalence also varies by population density. Statewide, the average county smoking rate is 13.8 percent. Lower rates are typically found in urban areas, while rural areas boast some of the highest rates in the state. However, there are urban pockets where smoking rates remain higher than average. For example, San Francisco and Sacramento, which together are home to about 1.7 million adults, have smoking rates of 14 percent and 17.9 percent, respectively (Figure 5).

Figure 5: CA Adult Smoking Prevalence, 2011-2012



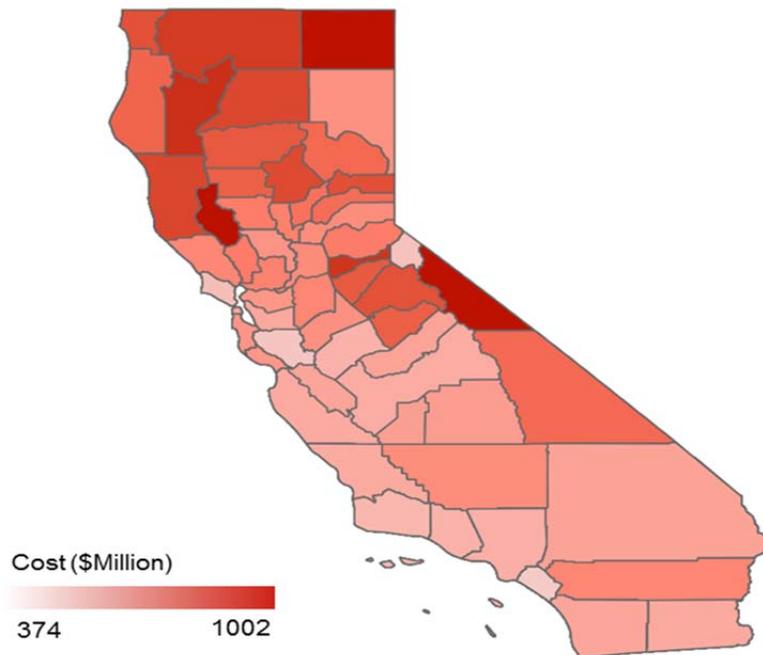
Source: California Health Interview Survey, 2011-2012.
California Department of Public Health, California Tobacco Control Program, California Tobacco Facts and Figures 2015.

The financial cost of this tobacco use is enormous. Research supported by the TRDRP on the cost of smoking in California found that in 2009 the economic burden of smoking in the state amounted to \$18.1 billion. Direct healthcare costs of smoking accounted for \$9.8 billion; lost productivity due to illness accounted for \$1.4 billion; lost productivity from premature death added up to \$6.8 billion; and expenditures for hospital care of current and former smokers amounted to \$4.3 billion.

The research also found a significant variation in per-resident cost of smoking among counties, ranging from \$374 in Orange County to \$1,002 in Lake County (Figure 6). These “county-level estimates of the costs of smoking help to identify geographic disparities in the economic burden of tobacco use,” said co-

author Hai-Yen Sung, Ph.D., Adjunct Professor, UCSF, and allow “local governments and policy makers to develop more effective tobacco control policies.”

Figure 6: Cost of Smoking in California by County, 2009 (in \$millions)



Source: The Cost of Smoking in California. Wendy Max PhD, Hai-Yen Sung PhD, Yanling Shi MS, Brad Stark BA. *Nicotine & Tobacco Research*, 2015, pp 1–8.

There are also immeasurable emotional costs. The American Cancer Society estimates that 18,430 women and men in California will be diagnosed with — and 12,370 will die from — lung or bronchus cancer in 2015. Ninety percent of these deaths will be attributed to tobacco use. Tens of thousands more will die from heart and respiratory diseases and other tobacco-related cancers.

Impact of TRDRP Funding on Tobacco Control Efforts in California

The TRDRP supports outstanding research that facilitates the elimination of smoking and tobacco use and mitigates the human and economic costs of tobacco use in California. This effort includes:

- widely disseminating the research findings through a variety of media,
- encouraging and supporting new scientific infrastructure and networks critical for a comprehensive approach to tobacco control and
- serving as an information resource for those interested in current research on tobacco control and tobacco-related disease.

Every four years, TRDRP undergoes a strategic planning process similar to the one detailed in Section II of this report. Annually, TRDRP reviews and updates its research priority areas and mechanisms to

ensure they are adequately addressing the current issues in the tobacco field. A more focused review of the program occurred in 2013, when UC appointed a Portfolio Review Group (PRG) to review its systemwide research portfolio.

The following sections of the report are excerpted from those various programmatic reviews and illustrate the depth and reach of TRDRP’s impact.

Investigator-initiated Research in TRDRP Priority Areas

At its inception, TRDRP organized its research portfolio into broad areas of tobacco-related disease (i.e., cancer, cardiovascular, pulmonary) as well as around areas of study (i.e., epidemiology, social/behavioral, tobacco use intervention, engineering, and general biomedical science). Over the past 25 years, federal level attention and funding for tobacco-related diseases and issues increased, the research field changed, and the tobacco industry evolved. In response, TRDRP strategically refined its priorities and investments to focus on the most underfunded and emerging critical areas of study of highest priority in California.

During the past five years, TRDRP offered investigator-initiated grant support in five priority areas (Section III, Table 1):

- Disparities, Prevention, Cessation and Nicotine Dependence;
- Early Diagnosis and Pathogenesis;
- Environmental Exposure and Toxicology;
- Industry Influence and Policy; and
- Regulatory Science and New Products.

By inviting investigator-initiated research in underfunded and emerging areas, TRDRP harnessed the most innovative ideas and approaches from the broadest range of disciplines to achieve its strategic goals.

By inviting investigator-initiated research in underfunded and emerging areas, TRDRP harnessed the most innovative ideas and approaches from the broadest range of disciplines to achieve its strategic goals. This seed funding for leading-edge research also offered California investigators a “leg up” in obtaining federal and private funding. A survey of 85 University of California principal investigators found that 29 credited their ongoing TRDRP funding for their ability to obtain additional funding. At UC alone, a total of \$9,444,462 in TRDRP-invested funds led to a total of \$30,374,383 in external funding to these investigators and their collaborators, a 322 percent return on investment.

Importantly, research in TRDRP’s five priority areas advanced biomedical and policy related issues both inside and outside of California. This investigator-initiated research included:

Reversible Covalent Kinase Inhibitors to Combat Metastasis

Shyam Krishnan, Ph.D., Research Associate, UCSF, studied the mechanisms of some of the targeted therapies now being used in cancer care. He developed a new type of targeted therapy that has the potential to hone in on cancer cells rather than normal cells, resulting in fewer side effects. Dr. Krishnan told TRDRP, “*This grant and the work that it funded have enabled commercialization of the technology*

that I have developed in the form of a patent that has been licensed to a biotech company (Principia biopharma)."

SMART: Sequential Motion Adaptation to Improve Lung Cancer Radiation Therapy

Dan Ruan, Ph.D., Assistant Professor, Radiation Oncology, UCLA, developed a way to improve the spatial precision of stereotactic (localized) radiation therapy used to treat cancer. Dr. Ruan said, *"TRDRP funding has led to multiple high-impact talks and discussions. It has pushed the vendors to commercialize a motion-adaptive radiation treatment module along the logic in this grant."*

Cigarette Smoke and Lung Injury: Mechanism of nSMase2 action

Simone Filosto, Ph.D., Graduate Student, UC Davis, studied how the molecules inside cells interact during the process that leads cigarette smoke to cause lung disease. Identifying this mechanism could lead to new lung treatments. Dr. Filosto said, *"TRDRP funding led to the discovery of the phosphorylation-based machinery controlling nSMase2 function, which is a novel target in cigarette smoke-induced lung injury diseases."*

Negative Effects of Smoke on Novel HDL Mimetic Therapies

John Bielicki, Ph.D., Staff Scientist, Lawrence Berkeley National Laboratory, investigated whether cigarette smoke impairs an important protective mechanism in HDL-cholesterol that fights against the development of atherosclerosis, a common form of heart disease. Dr. Bielicki said, *"I received research funding from private sources to help commercialize our new peptides for clinical applications, i.e. to enable . . . an investigational new drug and human testing."*

Quantitative Proteomics of Oral Precancer Progression

Shen Hu, Ph.D., Associate Professor, UCLA School of Dentistry, identified proteins that could be used as biomarkers to determine whether a pre-cancer was likely to progress into an aggressive cancer. Dr. Hu said, *"The TRDRP grant led to the discovery of novel biomarkers for detection of oral cancer."*

Cost of Smoking

Stanton Glantz, Ph.D., American Legacy Foundation Distinguished Professor of Tobacco Control, UCSF, found raising cigarette taxes \$1 per pack and having \$0.20 of this increase go to tobacco control efforts would result in healthcare costs falling from between \$3.3 billion and \$28.2 billion between 2012 and 2016. Dr. Glantz said, *"This analysis has been used in California Department of Public Health materials and by the U.S. Centers for Disease Control and Prevention ..."*

The Cost of Smoking for California's 58 Counties

Wendy Max, Ph.D., Professor of Health Economics and Co-Director of the Institute for Health & Aging, UCSF, conducted research that determined 4,174 fewer Californians would die if tobacco taxes were increased. Dr. Max reported, *"The results from this grant will be widely used for California tobacco control policy. Our research methods are used nationally and internationally."*

Community-based Research

As overall smoking rates declined in California, the demographics of the smoking population changed, with smoking now concentrated in special populations. Integral to the fulfillment of TRDRP's public benefit mandate are the grants it gives to support community-based participatory research that targets these specific groups and communities. These grants are provided through TRDRP's Community/School

Academic Research Awards (CARA and SARA), which engage researchers and community/school-based partners in truly collaborative research efforts from conceptualization of the project to eventual dissemination and application of its findings.

With these funds, researchers developed innovative culturally- and linguistically-specific interventions for the state’s diverse populations that have reduced tobacco-related health disparities as well as changed health delivery systems in California and nationally. These groups included:

Veterans

Jeffrey Bassett, M.D., developed a smoking cessation program for veterans during his residency in the Department of Urology at the David Geffen School of Medicine at UCLA. Dr. Bassett reported, *“As of this date, the research supported by the TRDRP remains the best evidence that the diagnosis of bladder cancer is a teachable moment that medical providers should leverage to increase the newly diagnosed motivation to quit smoking. At the local level, the West Los Angeles Veterans Affairs Hospital has implemented a pilot tobacco screening and cessation protocol for all veterans referred for signs and symptoms consistent with bladder cancer. Once vetted, the plan is to disseminate this protocol throughout the VA system. Currently, we have identified six potential hospital sites for dissemination, with each geographic region of the continental U.S. represented.”*

Integral to the fulfillment of TRDRP’s public benefit mandate are the grants it gives to support community-based participatory research that targets these specific groups and communities.

The Deaf Community

Barbara Berman, Ph.D., Professor of Public Health, UCLA, developed an anti-smoking curriculum called “Hands Off Tobacco” for children and adolescents who are deaf and hard-of-hearing. The curriculum includes lessons about self-esteem and self-concept; the influence of peers and tobacco-industry marketing; the health effects of tobacco use; and anti-tobacco social action. Dr. Berman said, *“... the K-12 anti-smoking curriculum for deaf students is currently in use in a number of settings in which deaf children and adolescents receive their education.”*

The African-American Community

Ruth Malone, R.N., Ph.D., Professor of Social and Behavioral Sciences, UCSF School of Nursing, explored and described the impact of the tobacco industry’s efforts to attract older smokers and keep them from quitting as seniors. This included efforts to target African Americans, who have higher smoking rates than other groups. Dr. Malone reported, *“The work on tobacco industry targeting of African Americans opened up a whole area of advocacy in the Black community, which is now active around the menthol issue and FDA regulation, and was used in media campaigns.”*

The Vietnamese Community

Forty percent of Vietnamese Americans live in California. The 2007 and 2009 California Health Interview Survey found a smoking prevalence of 31 percent among Vietnamese-American men. It was even higher — 45 percent — among Vietnamese men who spoke limited English. Janice Tsoh, Ph.D., Associate Professor of Psychiatry, UCSF, identified effective culturally and linguistically appropriate family intervention strategies to address Vietnamese smokers’ low intention to quit and underutilization

of evidence-based smoking cessation resources. Dr. Tsoh said, “*We have disseminated findings to clinicians, researchers, community leaders and constituents. There has been a significant amount of interest expressed in future collaborations, including potential adaption of the intervention models for [other] underserved populations.*”

Special Initiatives

As mentioned in Section IV of this report, TRDRP selectively and strategically invests in research that addresses particularly challenging and/or underfunded areas as well as potentially groundbreaking and emerging tobacco-related issues of particular significance to California. This section of the report describes the outcomes and impact of these initiatives. Between 2010 and 2015, TRDRP invested in the following three high priority research areas:

- **Thirdhand Smoke Initiative**

Initially funded in 2011, the California Consortium on Thirdhand Tobacco Smoke brought together investigators from a broad range of disciplines with strong research backgrounds in the characterization, exposure and health effects of tobacco smoke. Administered at UCSF, the first phase of the Consortium’s work (2011–2014) was led by Neal Benowitz, M.D., Professor, School of Medicine, UCSF, and Lara Gundel Ph.D., Staff Scientist, Lawrence Berkeley National Laboratory (LBNL). Consortium institutions include UCSF, LBNL, UC Riverside, University of Southern California, San Diego State University and Portland State University. The consortium:

1. identified and examined new chemicals that form from secondhand smoke and thirdhand smoke when they age on indoor surfaces;
2. developed new ways to measure human exposure to thirdhand smoke in house dust, on surfaces and in people who are exposed to tobacco smoke;
3. learned how chemicals in thirdhand smoke cause genetic damage and affect the reproductive system; and
4. developed risk assessment models and projections of health care costs related to thirdhand smoke.

The TRDRP Thirdhand Smoke Initiative informed the passage of California legislative bill AB 1819. The bill, which went into effect in January 2015, prohibits smoking tobacco at all times in licensed family childcare homes and in areas where children are present.

This work resulted in 21 published scientific articles (Appendix III). The Consortium received a new TRDRP grant in 2015 to continue its work.

The Consortium’s research studies influenced state and federal policy decisions:

State Level

The TRDRP Thirdhand Smoke Initiative informed the passage of California legislative bill AB 1819. The bill, which went into effect in January 2015, prohibits smoking tobacco at all times in the homes of licensed family childcare homes and in areas where children are present. The research findings relevant to this legislation were disseminated throughout the state and country through widespread media coverage (Appendix IV).

Federal Level

The TRDRP’s Thirdhand Smoke Initiative informed the U.S. Department of Housing and Urban Development (HUD) Office of Lead Hazard Control and Healthy Homes call for research issued in June 2015 for the Healthy Homes Technical Studies Grant Program. Through this program, HUD will award an estimated \$2 million to advance the recognition and control of priority residential health and safety hazards and more closely examine the link between housing and health.

In its call for research, HUD included thirdhand smoke (THS) as one of its targeted areas of interest noting, “Some research has indicated that THS (i.e., the residue from tobacco smoke that collects on interior walls or surfaces) could result in significant exposure to toxic substances. Additional research is needed to improve our understanding of exposure to these residues and their potential health impact and the efficacy of cleaning techniques in reducing THS residue from surfaces in homes.”

- Lung Cancer Early Detection Initiative

TRDRP made a major investment in transformative research to develop non-invasive methodologies that could detect disease early in its course, when it is most responsive to therapy. TRDRP determined this was necessary to make a profound impact on lung cancer, offering the best possibility of filling a pronounced funding gap. At the time, lung cancer early detection represented only 9 percent of cancer funding at the federal level and only 6 percent of the TRDRP cancer portfolio, while the bulk of federal and TRDRP cancer funding was devoted to research directed toward developing treatments. In 2011, TRDRP awarded grants to support two translational research projects at UC Davis and UCLA that involved collaborations between laboratory researchers and clinicians and aimed at developing non-invasive, cost-effective early detection methodologies that have the potential to be made widely available to smokers, former smokers, and those exposed to tobacco smoke. In addition to the two translational projects, eight other investigator-initiated projects were funded under this initiative.

Investigators at UCLA studied a panel of biomarkers found in saliva that have the potential to be used in clinical practice for the non-invasive early detection of lung cancer.

The translational research projects are: “Salivary Biomarkers Development for Detection of Lung Cancer,” led by David Wong, D.M.D., Associate Dean of Research, UCLA, and “Integrated Multi-omics Approach to Detect Early Lung Cancer,” led by Karen Kelly, M.D., Professor of Medicine, UC Davis Medical Center.

Salivary Biomarkers Development for Detection of Lung Cancer

David Wong, D.M.D., Associate Dean of Research, UCLA School of Dentistry, and three fellow investigators at UCLA studied a panel of biomarkers found in saliva that have the potential to be used in clinical practice for the non-invasive early detection of lung cancer. Findings from their research resulted in six publications (Appendix V). This research also led to the development of a new technology called Electric Field-Induced Release and Measurement (EFIRM). EFIRM extracts exosomes (microvesicular structures that play a mediating role in intercellular communication) from biofluids, unloads their cargo, and tests their internal RNA/protein content to identify specific cancer mutations in blood and saliva. In short, it is a method for performing a liquid biopsy that has the potential to revolutionize cancer detection and treatment.

For example, lung cancer patients whose tumors have an abnormal (mutated) gene that produces a modified version of a protein called “epidermal growth factor receptor (EGFR)” can be treated with an EGFR-targeted therapy. This is the type of personalized medicine driving the cancer research field. Currently, a tissue biopsy — which is invasive, expensive and time consuming — is used to determine the tumor’s EGFR status. Dr. Wong and his colleagues published research November 15, 2014, in the *American Journal of Respiratory and Critical Care Medicine*, that used EFIRM to detect EGFR mutations in the saliva of 40 patients with non-small cell lung cancer.¹¹ The study showed the EFIRM liquid biopsy — which is rapid, user-friendly and cost-effective — accurately detected EGFR mutations in saliva. This suggests EFIRM could offer an easy, inexpensive way to identify the most effective cancer treatments for each patient. It also suggests EFIRM could be used for cancer screening. Dr. Wong and his team are conducting larger studies to confirm these findings.

Integrated Multi-omics Approach to Detect Early Lung Cancer

Karen Kelly, M.D., Professor of Medicine, and her colleagues at UC Davis are part of an internationally recognized multidisciplinary lung cancer clinical program. They are leaders in a new specialized field that uses sophisticated research tools to study a broad range of substances, such as sugars (glycomics), fats (lipidomics), and chemicals (metabolomics), which can be used for cancer screening or diagnostic purposes. Studies have already demonstrated differences in sugars, fats, and chemicals in cancer patients compared to healthy volunteers. Dr. Kelly received TRDRP funding to discover which sugars, fats and chemicals can consistently distinguish lung cancer from individuals without lung cancer and to identify and test promising biomarkers found in the blood of patients before a diagnosis of lung cancer. Findings from this translational research grant resulted in two publications (Appendix V). A third manuscript has been submitted to *Proteome Research*. These research papers delineate some of the research milestones achieved by the research team. This includes the identification of a candidate blood chemical signature for adenocarcinoma and the largest ever evaluation of chemical and sugar signatures in cancerous and healthy tissue.

Next, Dr. Kelly’s team will collect blood samples on all patients with an indeterminate pulmonary nodule, a companion study to a recently awarded Patient-Centered Outcomes Research Institute grant in CT screening. They leveraged this award from their TRDRP funding. Dr. Kelly and her UCD colleague Dr. Suzanne Miyamoto also reported, “*We have leveraged the funding from the TRDRP to acquire additional funding from the LUNgevity Foundation for early detection of lung cancer. The LUNgevity award is a two-year award (I am the Principal Investigator on this award) that one of its objectives is to further analyze lung tissue samples (malignant and non-malignant) using the same technologies (metabolomics and glycomics) as we are using the blood assays proposed in the TRDRP. ... Oliver Fiehn, whose metabolomics laboratory does the metabolomic analyses for the TRDRP projects, was awarded a NIH grant to become the NIH West Coast Metabolomics Core. This huge honor was in part due to some of the research effort conducted by the Fiehn laboratory for the lung cancer projects.*”

¹¹ Wei F, Lin CC, Joon A, Feng Z, Troche G, Lira ME, Chia D, Mao M, Ho CL, Su WC, Wong, DTW. Noninvasive saliva-based EGFR gene mutation detection in patients with lung cancer. *Am J Respir Crit Care Med*. 2014.190 (10):1117-1126.

- Rapid Policy Research Initiative

The Rapid Policy Research Initiative provided funding for researchers to quickly carry out and publish research that addressed pressing tobacco control related policy issues facing California. The TRDRP worked with a collaborative policy advisory committee to identify research areas of greatest significance.

During this period, the Rapid Policy Research Advisory Committee identified the economic impact of smoking and the contribution of cigarette taxes as their focus. The committee included representatives of the American Cancer Society, the American Heart Association, the American Lung Association, the Lung Cancer Alliance, Americans for Non-Smokers Rights, the California Department of Health, the California Department of Education, and local tobacco control advocates.

Following a competitive peer-reviewed process, three teams received funding to conduct policy research in these areas and to produce a final report that was distributed broadly to policymakers and stakeholders throughout the state.

The first team was led by Stanton Glantz, Ph.D., American Legacy Foundation Distinguished Professor of Tobacco Control, UCSF, and James Lightwood, Ph.D., Associate Professor, UCSF School of Pharmacy. They estimated the effect of the California Tobacco Control Program on state health care costs, the number of cigarette packs not smoked (not sold) and the cost to the tobacco industry. They also projected what is likely to happen over the next three years to smoking and health care costs if the same level of funding for tobacco control is maintained, if the monies going to tobacco control are increased, and if the California Tobacco control program was funded at the CDC recommended level. They also projected what would occur if the tobacco control monies were cut by 25 percent, 50 percent, 75 percent or 100 percent. This work resulted in the research publication “The Effect of the California Tobacco Control Program on Smoking Prevalence, Cigarette Consumption, and Healthcare Costs: 1989–2008” in *PLoS One*.¹²

The second team was led by Wendy Max, Ph.D., Professor of Health Economics and Co-Director of the Institute for Health & Aging, UCSF, and Hai-Yen Sung, Ph.D., Adjunct Professor, Institute for Health and Aging, UCSF. They evaluated the economic impact of California’s Tobacco Control Program with a dynamic model that could assess the economic aspect specifically for African Americans and Hispanics. The model was also used to evaluate the human impact of alternative tobacco control policies, including their impact on mortality, and to calculate healthcare expenditures by socioeconomic group.

This work resulted in two research publications: “Evaluation of the economic impact of California’s Tobacco Control program: a dynamic model approach” in *Tobacco Control*, and “The Disproportionate Cost of Smoking for African-Americans in California” in the *American Journal of Public Health*.^{13,14}

¹² Lightwood J, Glantz SA. The effect of the California Tobacco Control Program on smoking prevalence, cigarette consumption, and healthcare costs: 1989–2008. *PLoS ONE*. 2013; 8(2): e47145.

¹³ Miller LS, Max W, Sung HY, et al. Evaluation of the economic impact of California’s Tobacco Control Program: a dynamic model approach. *Tob Control*. 2010;19:Suppl 1 i68-i76.

¹⁴ Max W, Sung HY, Tucker LY, Stark B. The disproportionate cost of smoking for African Americans in California. *Am J Public Health*. 2010 Jan;100(1):152-8.

The third team was led by John Pierce, Ph.D., Distinguished Professor, Department of Family & Preventive Medicine, UC San Diego, and Karen Messer, Ph.D., Director, UC San Diego Moores Cancer Center Biostatistics/Bioinformatics shared resource. They evaluated per capita consumption differences between California and other U.S. states and whether per capita consumption trends from 1960 through 2002 were explained by differences in cigarette price and tobacco control expenditure. The team also determined the association between rate of decrease in per capita consumption and lung cancer incidence, which resulted in California lung cancer rates dipping below the rest of the nation in 1992.

This team also looked at birth cohort data to project expected cumulative consumption to age 65 years for the younger birth cohorts and identify differences between California and the rest of the nation in smoking initiation, cessation and changes in consumption among smokers. In addition, they modeled birth cohort- and age-specific lung cancer rates for California and the rest of the nation by cumulative consumption experience.

Their research paper “Forty Years of Faster Decline in Cigarette Smoking in California Explains Current Lower Lung Cancer Rates” was published in *Cancer Epidemiology, Biomarkers & Prevention*.¹⁵

Career Development

Since its inception, the TRDRP has provided training support for postdoctoral fellows and new investigators, as part of its commitment to the development of a new generation of tobacco-related disease researchers. During its strategic planning process in 2014, the TRDRP evaluated the return on investment of career development awards funded between 2005 and 2014. This time period was chosen in order to allow the TRDRP to fully assess career outcomes in a way that would inform efforts to identify the new priorities that are now in place. The evaluation showed that during this time period TRDRP invested \$22 million in new tobacco researchers through 54 Dissertation Awards, 89 Postdoctoral Awards and 41 New Investigator Research Awards.

A review of 94 of these awards found that each grant advanced the research field with, on average, three publications. TRDRP funding was also a clear stepping stone for additional funding, with these 94 awards leading to an additional \$33,103,417 from other funders. The review also found many of the researchers who received TRDRP funding continued to stay in the tobacco field, with rates ranging from 34 percent to 73 percent, depending on award type.

Investigators who have received career development awards report the funding has shaped and advanced their careers. For example:

TRDRP provides support for postdoctoral fellows and new investigators, as part of its commitment to the training and development of a new generation of tobacco-control and tobacco-related disease researchers.

¹⁵ Pierce JP, Messer, K et al. Forty years of faster decline in cigarette smoking in California explains current lower lung cancer rates. *Cancer Epidemiol Biomarkers Prevent*. 2010; Nov.19:2801-2810.

Dr. Maie St. John was a young surgeon, clinician and researcher at UCLA's David Geffen School of Medicine when she received a TRDRP New Investigator Award to study the epithelial-mesenchymal transition in head and neck cancer, which helped her achieve tenure. She reported, *"The TRDRP has been my lifeline to keep my research career going. The sustenance I derive(d) from my New Investigator grant is invaluable! The harsh truth is that without this grant, it would be very difficult to maintain protected research time. I thank you on behalf of my patients and all the questions I hope to try to answer for them."*

Marialena Gonzalez said, *"My postdoctoral grant allowed me to become very competitive on the job market. I was offered a position at Johns Hopkins Bloomberg School of Public Health. As a result of my continued postdoc, I obtained my top choice job as an Assistant Professor of Public Health at UC Merced, which I started July 1, 2013."*

Jeffrey Bassett, who received a New Investigator Award while at UCLA told us, *"This award was instrumental in my young academic career as a surgeon scientist. As a result of research supported by TRDRP I have received two competitive merit awards and had the opportunity to discuss my research at four national meetings within the past year. The award also has allowed me to join a growing cadre of urologic health service researchers whose goal is to improve the quality of urologic care."*

II. TRDRP's Strategy for Allocating Research Funds

The Tobacco-Related Disease Research Program (TRDRP) was designed to be a unique funding source that could leverage the breadth of the state's scientific resources. The rigorous research culture at the University of California in general, and the UC Office of the President Research Grants Program Office in particular, guides and shapes TRDRP's grantmaking policies and procedures.

The Research Grants Program Office sets current standards, identifies best practices, and provides grant-making systems that help TRDRP support researchers in submitting applications, managing TRDRP research grants and contracts, and measuring and communicating the impact of research in California and beyond.

TRDRP is one of four programs housed at the Research Grants Program Office; the three other programs are the California Breast Cancer Research Program, the California HIV/AIDS Research Program, and the University of California Research Initiatives.

Strategic Planning

The TRDRP regularly receives input from multiple sources to assess the current needs in tobacco-related research. In 2010, TRDRP initiated a strategic planning process for transforming the program's funding priorities and mechanisms in ways that would better position the program to respond to biomedical and scientific advances. Policy gaps and the impact of new tobacco products, like e-cigarettes within the context of continually declining Proposition 99 revenues, were also explored. During the strategic planning process, input and data were obtained from three groups — TRDRP stakeholders, funded grantees and the TRDRP Scientific Advisory Committee (Appendix I).

The TRDRP stakeholders interviewed were a diverse group that included biomedical researchers, tobacco control program directors, social behavioral researchers, medical professionals, policy researchers, community tobacco control activists, health voluntary members, statewide tobacco control contractors, educators, grants administrators and others.

They were asked to evaluate the effectiveness of the TRDRP's grantmaking structure, which included funding streams for:

- individual investigator-initiated grants;
- collaborative grants with academic, community, and school partners; and
- large grants for special research initiatives that jump-start research in specific areas identified by the TRDRP.

The survey showed wide support for the TRDRP's primary funding mechanisms and special research initiatives.

The TRDRP staff also reviewed publications, citations, and federal grant dollars data on 123 TRDRP investigators. The review showed TRDRP investigators scored above the national average in percentage of publications, number of citations, and number of grants per investigator for the biomedical, public health, and social behavioral fields of investigation.

The data collected from stakeholders and staff was presented to the Scientific Advisory Committee, which used its Principles of Granting Priorities and Strategies as a guide to recommend program changes. These principles aim to:

- inform California tobacco control policies and programs,
- support unique areas of research as yet unfunded by other sources,
- leverage additional research funding,
- support the early careers of investigators in tobacco-related research,
- strengthen community involvement in tobacco control research,
- advance knowledge to reduce tobacco-related disparities, and
- strategically target resources in coordination and within the context of other funders.

TRDRP is recognized by the National Cancer Institute as a funding agency that meets its high standards for peer review and selection of award recipients.

Specifically, the Scientific Advisory Committee recommended updates to the TRDRP research priorities in response to the advances in tobacco science and changes in tobacco use, reductions in the size and scope of grant awards, and continued investment in emerging and underfunded research areas. These recommendations were introduced during the period covered by this report.

Grantmaking Decisions

The TRDRP adheres to strict program and operational requirements aimed at minimizing perceived or actual conflicts of interest. Its location in the UC Office of the President affords neutrality and availability to applicants and grantees statewide. In addition, its independent, competitive peer review process and attention to potential or perceived conflicts of interest assures applicants from across the state they will receive an unbiased and high quality review that meets the highest scientific and ethical standards. These efforts led the TRDRP to be recognized by the National Cancer Institute as a funding agency that meets its high standards for peer review and selection of award recipients.

In making grant determinations, the TRDRP employs multiple levels of scientific review of submitted proposals to ensure it selectively and strategically invests in research that addresses particularly challenging or underfunded areas, that is potentially groundbreaking, and that targets emerging tobacco-related issues of particular significance to California.

Research grant proposals submitted in response to the TRDRP's annual Call for Applications follow a peer review process modeled on the one used by the National Institutes of Health. This multi-step process begins with the screening of each application for relevance to TRDRP's mission.

Following screening and selection:

- the TRDRP staff compiles a panel of reviewers that are drawn from outside of California to minimize actual and apparent conflicts of interest;
- the reviewers score the grant in categories including, but not limited to: Significance, Study Design, Innovation, Study Team, and Environment/Institution Support;

- the review panel meets and discusses the strengths and weaknesses of the proposals and arrives at a final score for each proposal;
- the proposals are ranked within each review panel based on these reviewer scores and several potential funding models are proposed based on the funds available for that review cycle. The model attempts to achieve balance among the TRDRP priority areas while funding the most meritorious proposals;
- the funding model options are presented to the Scientific Advisory Committee, which makes recommendations to the University on which proposals to fund; and
- the Executive Director of the Research Grants Program Office gives final approval of the grants that are to be funded.

This process ensures the TRDRP funds high-quality, innovative research that promises to advance knowledge needed to improve tobacco control and the prevention and treatment of tobacco-related diseases.

III. Funding Highlights, 2010-2015

The mission of the Tobacco-Related Disease Research Program (TRDRP) is to support research on the prevention, causes, and treatment of tobacco-related disease and the reduction of the human and economic costs of tobacco use in California. To that end, between 2010 and 2015, the Scientific Advisory Committee recommended and the TRDRP awarded \$56,247,109 in 210 new grants to Principal Investigators from California not-for-profit organizations conducting research in California.

2010-2015 Research Mechanisms

Between 2010 and 2015, TRDRP solicited applications for the program’s 19th through 24th annual funding cycles. All applications, including continuation proposals, competed for funding through peer review. Below are the descriptions of the various research award mechanisms used by the TRDRP.

Single-Investigator Grant Mechanisms

<i>Investigator-Initiated Research Grants</i> Three types of investigator-initiated research grants were funded between 2010 and 2015	
Exploratory/Developmental Research Awards	<ul style="list-style-type: none"> • For researchers who intended to gather preliminary data or demonstrate proof-of-principle. • Provided the foundation for proposals for fully developed research project awards from TRDRP or other funding programs such as the National Institutes of Health.
Research Project Awards	<ul style="list-style-type: none"> • Supported work based on existing preliminary data.
California Research Awards	<ul style="list-style-type: none"> • Supported research projects that addressed tobacco-related disease or tobacco control issues specific to California.
<i>Career Development Grants</i> TRDRP offered four types of awards aimed at enhancing the scientific infrastructure for tobacco-related research in California by supporting the development of careers in research.	
Cornelius Hopper Diversity Award Supplements	<ul style="list-style-type: none"> • Encouraged TRDRP-funded researchers to mentor individuals who wished to pursue careers in research on tobacco use and tobacco-related disease. • Qualified applicants were from groups that were underrepresented among researchers who investigate tobacco use or tobacco-related disease, and/or individuals who wished to work directly with underrepresented groups that are disproportionately impacted by tobacco use.
Dissertation Research Awards	<ul style="list-style-type: none"> • Supported the dissertation research of doctoral candidates pursuing tobacco-related research.
Postdoctoral Fellowships	<ul style="list-style-type: none"> • Allowed researchers early in their careers to receive training in tobacco-relevant disciplines.
New Investigator Awards	<ul style="list-style-type: none"> • Encouraged newly independent investigators to conduct research on tobacco-related issues.
<i>Special Project and Research Dissemination Grants</i> TRDRP funded special projects such as scientific conferences and other research dissemination activities.	

Collaborative Community-Based Participatory Research Grants

In an effort to engage the communities most impacted by tobacco use, TRDRP utilized two collaborative community-based participatory research mechanisms to create opportunities for community members and researchers to work as equal partners in the research process. By creating a framework in which community members and researchers partner to combine their knowledge and to drive the full research process, collaborative community-based participatory research has been able to identify unique approaches to reduce health disparities and improve health systems, programs and policies. Community-based participatory research is recognized by the National Institutes of Health as an alternative research paradigm that integrates education and social action to: (1) improve health; (2) deepen the scientific knowledge base in the areas of health promotion, disease prevention, and health disparities; and (3) transfer evidence-based research from clinical settings to communities.

The TRDRP encouraged community-based participatory research through its Community Academic Research Awards and School Academic Research Awards.

- **Community-Academic Research Awards (CARA)**

These awards stimulated and supported collaborations between community-based organizations and university-based investigators to perform scientifically rigorous research into tobacco control issues important to California's diverse communities. For these grants, community is broadly defined as any group of individuals sharing a common characteristic, such as culture, language, race, ethnicity, gender, age, sexual orientation, or other attribute that might impact the effectiveness of tobacco control programs. CARA Pilot Awards supported the initial phases of a CARA project, including solidifying the collaborations, identifying research questions, negotiating roles and responsibilities, detailing the research plan and methods, and collecting pilot data. CARA Full Awards supported fully developed CARA projects that had more experienced research teams and/or preliminary results from prior studies.

- **School-Academic Research Awards (SARA)**

These awards stimulated and supported collaborations between schools and university-based investigators to perform scientifically rigorous research into tobacco control issues that are identified as important to schools in the state. Successful SARA awards were deemed likely to produce results that are meaningful to school-based prevention and intervention efforts and used methods that were relevant, culturally appropriate, and appropriate in terms defined and accepted by the schools. Schools could be public or private elementary, middle and high schools, continuation high schools, alternative, juvenile court or community schools. Each SARA grant was jointly funded by the California Department of Education Tobacco-Use Prevention and Education (TUPE) Program and the TRDRP. SARA Pilot Awards supported the initial phases of a SARA project, including solidifying the collaborations, identifying research questions, negotiating roles and responsibilities, detailing the research plan and methods, and collecting pilot data. SARA Full Awards supported fully developed SARA projects that had more experienced research teams and/or preliminary results from prior studies.

Special Research Initiatives

In 2010, the TRDRP initiated an extensive strategic planning process to transform both its funding priorities and the corresponding funding mechanisms. This process resulted in the development of three special research initiatives that address gaps in federal funding strategies and topic areas. These

initiatives better positioned TRDRP to respond to tobacco control and tobacco-related disease control needs in California and to address emerging scientific questions confronting the California tobacco control movement, health disparities associated with smoking in California, and the ongoing economic and public health costs that are the result of tobacco use.

- **Thirdhand Smoke Consortium**

Thirdhand smoke refers to the “residual tobacco smoke pollutants that remain on surfaces and in dust after tobacco has been smoked; or are re-emitted back into the gas phase; or react with oxidants and other compounds in the environment to yield secondary pollutants.”¹⁶ Toxic compounds so far identified in thirdhand smoke include many that have already been identified as toxic or cancer-causing agents. TRDRP granted \$3.6 million to support research by a competitively funded consortium of researchers (the only multi-disciplinary collaborative effort in the country) to study the nature and effects of tobacco smoke toxins and contamination that remain in the environment after a cigarette has been smoked and its impact on public health.

- **Early Detection of Lung Cancer**

Lung cancer is the leading cause of cancer death for both men and women. Smoking, particularly of cigarettes, is by far the main contributor to this disease. In the U.S. there are an estimated 45 million current and 45 million former smokers at risk for developing lung cancer. There currently is no practical way to screen these high-risk individuals. As a result, over 75 percent of lung cancer cases are diagnosed in late stages. Because early detection offers the promise of improved cure rates, TRDRP developed a Lung Cancer Early Detection Initiative grant process to advance the field of early detection. The Initiative began with an input/advisory meeting in February 2010. Attendees included lung cancer experts from across the U.S. and California, the American Cancer Society, and the patient advocacy community. The meeting resulted in a special Request for Applications released in 2011 that solicited applications involving collaborative efforts between technical experts and clinical partners.

- **Rapid Policy Research Initiative**

The Rapid Policy Research Initiative provided funding for researchers to quickly carry out and publish research that addressed pressing tobacco control related policy issues facing California. TRDRP worked with a collaborative policy advisory committee to identify research areas of greatest significance. The committee, which included representatives from the American Cancer Society, the American Heart Association, the American Lung Association, the Lung Cancer Alliance, Americans for Non-Smokers Rights, the California Department of Health, the California Department of Education and local tobacco control advocates, funded three rapid policy research teams.

Research Priorities

The 210 new grants that TRDRP funded between 2010 and 2015 using the mechanisms described above were awarded in five research priority areas. Specifically, 74 grants were awarded in the area of Disparities, Prevention, Cessation and Nicotine Dependence; 75 in the area of Early

¹⁶ Matt GE et al. When smokers move out and non-smokers move in: residential thirdhand smoke pollution and exposure Tob Control. 2011 Jan;20(1):e1. Epub 2010 Oct 30.

Diagnosis/Pathogenesis; 28 in the area of Environmental Exposure and Toxicology; 26 in the area of Industry Influence/Policy; and 7 in the area of Regulatory Science/New Products.

Financial reports of the income from Proposition 99 that made these grants possible and the TRDRP costs of funding these grants are detailed under the “Financial Tables” heading at the end of this section. Tables describing the grants funded under each priority are provided as an appendix to this report (Appendix IIa-IIf). Below we highlight some of the grants that were initiated in each priority area from 2010–2015.

Disparities/Prevention/Cessation/Nicotine Dependence

Tobacco use continues to cause disproportionately high rates of morbidity and mortality and reduced quality of life for California priority groups. These tobacco-related health disparities affect individuals, families, communities, and the economy in devastating ways. TRDRP-funded research in this priority area targeted the prevention and reduction of tobacco use and tobacco-related diseases among California’s disproportionately impacted groups, such as active military and veterans, blue collar workers, children, adolescents, young adults, racial/ethnic minorities and rural residents. Three of the grants awarded in this area were:

- Practice-based Intervention for Vietnamese and Korean Patients

Overall, Asian-American men have a higher smoking prevalence than non-Hispanic Whites. Within the Asian-American community, the highest smoking rates are seen in Vietnamese and Korean men. To reduce these high smoking rates, culturally appropriate strategies that increase awareness of and access to cessation resources are needed. A Community-Academic Research Award (CARA) granted in 2012 partnered Susan Huang, M.D., Medical Director, Asian Health Services in Oakland, and Janice Tsoh, Ph.D., Associate Professor of Psychiatry, UCSF. They leveraged the role Asian Health Services plays as a point of health care access to develop a culturally appropriate intervention targeting Vietnamese and Korean patients that promotes smoking cessation with evidence-based treatments in a community health setting.

For the intervention, Drs. Huang and Tsoh produced a Vietnamese and Korean branch-logic video program that is given to patients immediately before they meet their provider. The interactive video features providers at Asian Health Services and the co-investigators offering information and advice on how to quit smoking, including medical options. It also incorporates Clinical Practice Guidelines for smoking cessation, and asks patients questions about their smoking status and patterns and their interest in or readiness to quit. This information is provided to the medical providers, who offer additional information about quitting based on the patient’s response. The video has the potential to inform best practices for smoking cessation in low-income Asian ethnic groups, reducing this population’s overall high rates of tobacco use. Drs. Huang and Tsoh received a new grant in 2015 to continue their work with Vietnamese and Korean patients and to expand the reach of their intervention by developing a culturally appropriate version for Chinese smokers.

- A Youth Development & Parent Toolkit for Tobacco Education

Schools provide a promising venue for tobacco prevention efforts. However, previous school-based tobacco education efforts have had mixed results, with some successfully reducing tobacco use and others having no effect. A School-Academic Research Award (SARA) granted in 2012

joined developmental psychologist Bonnie L. Halpern-Felsher, Ph.D., Professor of Adolescent Medicine, Stanford School of Medicine, and Stephen Smuin, an educational consultant. They developed, tested and disseminated a new, more flexible toolkit to reduce and prevent middle and high school students' tobacco use, including cigarettes, cigars, smokeless tobacco, hookah and all electronic-cigarettes. The development process included gleaning information from students, educators and stakeholders about what is missing from school-based tobacco education programs and how they could be improved. The new toolkit, "The Tobacco Prevention Toolkit: For a Nicotine-Free Adolescence," has five modules, each of which will have been developed and tested by youth, educators, parents and teachers. The modules are:

- *What is Nicotine Addiction?*, which focuses on biological, physiological, and psychological aspects of nicotine addiction;
- *Applying Positive Youth Development to Tobacco Prevention*, which is aligned with the educational curriculum and uses a strength-based approach to tobacco education;
- *Youth Tobacco Prevention Information for Parents*, which educates parents on current tobacco control information;
- *School-based Information and Policies for Parents/Caregivers*, which enables parents to support, mirror and extend tobacco-education efforts in the home that are occurring at school; and
- *Electronic Cigarette/Vape Prevention*, which addresses myths and misperceptions about e-cigarettes and other electronic nicotine delivery systems and educates students about the advertising and marketing schemes designed to get them to start using these products.

**TRDRP-funded
researchers
developed, tested and
disseminated a new
toolkit to reduce and
prevent middle and
high school students'
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including cigarettes,
cigars, smokeless
tobacco, hookah and
all electronic-
cigarettes.**

The toolkit will be online, hosted at Stanford University, and available to educators and parents throughout the state. Each module and activity will contain hyperlinks, graphics, handouts and electronic documents that educators and parents can use with their students/children. By using a science-based, community-based approach to developing a tobacco education toolkit for students, educators and parents in California, this research has the potential to successfully reduce tobacco use among middle and high school students and, in turn, decrease this generation's risk of dying of tobacco-related illnesses.

- Menthol Cigarette Smokers: nAChR Levels and Treatment Effects

Menthol cigarettes comprise about one-third of all cigarettes sold in the U.S. These cigarettes are specifically marketed by the tobacco industry to urban smokers in minority racial/ethnic groups. Moreover, the majority of smokers from vulnerable populations — who also have the highest incidence of smoking — use mentholated products. A combination of physiological, psychological and societal factors can contribute to smoking behaviors. However, the type of cigarette smoked — menthol in particular — also is a factor. For example, studies have found menthol flavoring decreases the rate at which nicotine is removed from the body. This is thought

to impact brain nicotine receptors in ways that result in a stronger addiction to menthol cigarettes and make it more difficult for smokers of mentholated cigarettes to quit.

Arthur L. Brody, M.D., Research Psychiatrist, UCLA Department of Psychiatry and Biobehavior, received an Exploratory/Developmental Research Award in 2010 to study the effect that cigarette smoking has on the density of $\alpha 4\beta 2$ *brain nicotinic acetylcholine receptors (nAChRs) in menthol and non-menthol cigarette smokers. Dr. Brody found menthol cigarette smokers had a greater number of brain nicotine receptors than non-menthol smokers prior to starting a smoking cessation treatment.

As of July 2013, Dr. Brody had published seven papers in academic journals on his findings. This included “Up-regulation of Nicotinic Acetylcholine Receptors in Menthol Cigarette Smokers, published online November 21, 2012, in the *International Journal of Neuropsychopharmacology*, which described how menthol changes the brain and increases addictiveness to nicotine.¹⁷

By providing the science behind the observation that menthol smokers find it harder to quit than smokers of non-mentholated cigarettes, this research can contribute to the development and administration of more effective treatments for nicotine dependence. It can also inform efforts throughout the country to restrict the sale of menthol products within certain distances of schools. Chicago and Baltimore have both instituted such restrictions and similar efforts are underway in local municipalities in California, including the cities of Berkeley, Oroville and Oakland as well as cities in Sacramento, Santa Clara, San Benito and San Joaquin Counties.

Early Diagnosis/Pathogenesis

The development of early detection strategies often involves characterizing the molecular mechanisms involved in the pathogenesis (the origin and development of a disease) of cancer. The more unique the mechanisms are to a particular cancer the more likely they are to be effective biomarkers for early detection.

Such characterization also lends itself to precision medicine strategies, which aim to tailor therapies to the molecular features of the disease and/or the patient. It may also lead to new imaging methods that allow doctors to see and remove early-stage cancers.

TRDRP funded research to identify state-of-the-art methods for early detection and screening and novel and innovative treatments for lung cancer. Three of the grants awarded in this area were:

- High Resolution Imaging & Ablation for Smoke Induced Cancer
Tobacco induced lung cancer is aggressive and difficult to detect. For patients with non-small-cell lung cancer, early diagnosis and accurate and complete surgical removal of the tumor is

TRDRP has funded research to identify state-of-the-art methods for early detection and screening and novel and innovative treatments for lung cancer.

¹⁷ Brody AL, Mukhin AG, et al. Up-regulation of nicotinic acetylcholine receptors in menthol cigarette smokers. *Int J Neuropsychop*. 2013; Jun16 (5) 957-966.

critical, providing the only option for a cure. Jun Zhang, Ph.D., Assistant Project Scientist, UC Irvine Beckman Laser Institute, received a New Investigator Award in 2011 to develop a novel endoscopic method for identifying early-stage lung cancer as well as removing pre-cancers.

Dr. Zhang and his colleagues designed, fabricated and conducted feasibility testing in animal models of an integrated system that combined an ablation laser with an imaging system probe that could be used for both detection and treatment of early-stage lung cancer. This technique capitalizes on the knowledge that many cancers begin as pre-malignant lesions that can be treated or removed, thereby preventing them from becoming lethal cancer. Colonoscopy, which allows for identification and removal of potential precancerous polyps and early-stage cancers, is one example of a technique that is used for both cancer screening and prevention.

By pursuing the development of an endoscopic method for identifying and removing early-stage lung cancers, this research has the potential to significantly improve outcomes and treatments for patients with smoking induced lung cancer. The surgical laser could also potentially be used to detect and treat tobacco related cancers and pre-malignant lesions in other tobacco-exposed regions, such as the gastrointestinal and lower urinary tracts as well as play a key role in prostate cancer detection and resection, brain tumor resection and other microsurgical procedures.

- Salivary Biomarkers Development for Detection of Lung Cancer

Over 75 percent of lung cancer cases are diagnosed in late stages because there remains no practical way to screen a large number of people at risk. Early detection offers the promise of improved cure rates; first, however, strategies to identify high-risk individuals are needed. As a mirror of the body, saliva is readily accessible and harbors diverse microbial or host-origin contents that may serve as telltale molecules that could be used to monitor health status, disease onset, treatment responsiveness and outcome.

David Wong, D.M.D., Associate Dean of Research, UCLA School of Dentistry, led a team that identified discriminatory biomarkers in saliva that can detect lung cancer, with the aim of reducing the number of unnecessary diagnostic workups in patients with highly suspicious chest symptoms. This entailed accruing and analyzing 1,560 saliva samples from patients with suspicious chest symptoms, identifying potential biomarkers with data mining techniques, validating candidate biomarkers and developing a biomarker panel that could be clinically tested for lung cancer detection.

Dr. Wong and his colleagues are the leading research team in salivary diagnostics funded by the National Institute of Health to develop salivary biomarker and point-of-care biosensor platform technologies. This TRDRP grant allowed them to perform the definitive and pivotal human clinical validation study necessary to illustrate Electric Field-Induced Release and Measurement, a new technology they developed to detect specific genetic mutations in the saliva of 40 patients with non-small cell lung cancer, suggesting it has the potential to be an effective screening test.

- 50,000-Fold Signal Enhancement for Imaging Vulnerable Plaque

Smoking nearly doubles the risk of stroke, and as many as 30 percent of all coronary heart disease deaths in the U.S. each year are attributable to cigarette smoking. Atherosclerosis, the accumulation of lipid as plaque in the walls of major blood vessels of both the brain and heart,

plays a key role in these deaths. Identification of atherosclerosis, in particular high-risk vulnerable plaque, at an early stage has become a major focus of imaging research.

Pratip K. Bhattacharya, Ph.D., Staff Scientist, Huntington Medical Research Institutes, received a TRDRP New Investigator Award to develop a family of vastly improved imaging techniques to screen tobacco users for their stroke and heart attack risk, and to initiate and monitor the efficacy of preventive and therapeutic interventions. The two methods Dr. Bhattacharya developed can render over 50,000-fold signal enhancement. This makes it possible to target vulnerable plaque most at risk of rupture. It also makes it possible to characterize plaque components and their functions as well as identify potential diagnostic biomarkers. This research has the potential to lead to the development of an inexpensive, yet specific and sensitive screening test for the earliest detection of vulnerable plaque in the carotid artery and if possible, in the coronary arteries, providing opportunities for stroke prevention.

Environmental Exposure/Toxicology

The full impact of secondhand and thirdhand smoke on human health is not fully understood. Secondhand smoke is a Class A carcinogen - there is no risk-free exposure level to this pollutant. Thirdhand smoke refers to the residual tobacco smoke pollutants that remain on surfaces and in dust after tobacco has been smoked, are re-emitted back into the gas phase, or react with oxidants and other compounds in the environment to yield secondary pollutants. Toxic compounds so far identified in thirdhand smoke include many that are also present in secondhand smoke and mainstream smoke, as well as additional chemical compounds. In order to support policies designed to minimize involuntary exposure to secondhand smoke and thirdhand smoke, research is needed to understand exposure and health risks in areas like multi-unit housing and casinos as well as the social-behavioral economic and legal barriers to adoption of smoking bans in these and others areas. Research also is needed on the health effects of skin absorption of thirdhand smoke and the chemical changes that occur in secondhand and thirdhand smoke over time. Three of the grants awarded in this area were:

- Identifying and Measuring Secondhand Smoke in Multi-Unit Dwellings

According to the National Human Activity Pattern Survey, the average U.S. resident spends 69 percent of his/her time inside at home. For many nonsmokers living in multi-unit dwellings, the intrusion of secondhand smoke into their residence from adjacent units represents their major source of exposure to tobacco smoke. This intrusion can occur via multiple routes. Secondhand smoke can leak under doors and through small openings in walls, such as plug outlets. It can also exit the open windows of a smoker's unit and enter the open windows of other units. Smoking on balconies creates a cloud of concentrated secondhand smoke in close proximity to the windows of other residents.

Currently, studies assessing the health effects of secondhand smoke typically only assume or estimate the level of exposure, relying either on particulate matter concentrations, which can originate from sources besides cigarettes, or on nicotine levels,

**Stanford University
researchers developed
and tested new
measurement tools
and an experimental
protocol for accurate
assessment of
secondhand smoke
exposure in multi-unit
dwellings**

which can be substantially reduced via aging processes, including chemical transformations and losses to walls. To remedy this, tools for accurately measuring secondhand smoke are needed.

Lynn Hildemann, Ph.D., Associate Professor, School of Engineering, Stanford University, received a TRDRP California Research Award in 2010 to create an effective way to assess secondhand smoke levels inside multi-unit dwellings. Dr. Hildemann and her colleagues developed and tested new measurement tools and an experimental protocol for accurate assessment of secondhand smoke exposure in multi-unit dwellings that can account for other potential indoor sources of pollutants. This research has the potential to allow for more accurate health risk assessments of secondhand smoke as well as improve educational programs and policies designed to reduce exposure to secondhand smoke.

- Reactive Oxygen Species in Fresh and Aging Secondhand Smoke Particles

Secondhand smoke is a major source of human exposure to fine particles in indoor environments. In comparison to homes without smokers, homes with smokers have indoor particle levels that are higher by 70–75 percent. Particles emitted from secondhand smoke are in the fine to ultrafine size, are inhaled deep into the lungs, and cause an array of adverse health effects, such as coronary heart disease, lung cancer, and chronic obstructive pulmonary disease. It is known that secondhand smoke particles have adverse effects, but the mechanisms that cause these health effects are not fully understood.

Reactive oxygen species (ROS), such as free radicals and peroxides, are environmental trace pollutants potentially associated with asthma and airways inflammation. Cigarette smoke represents a major source of ROS in indoor air. Most studies of the composition of cigarette smoke aerosols and ROS are based on techniques in which samples are collected and analyzed subsequently. Very little is known about how the chemical composition and concentration of ROS in secondhand smoke particles change in real time. Yet, secondhand smoke particles are likely to undergo dynamic complex transformations that could transform their chemical composition, physical, and toxicological properties.

Mohamad Sleiman, Ph.D., Research Scientist, Lawrence Berkeley National Laboratory, received a TRDRP Postdoctoral Fellowship Award to develop and validate an experimental method using fluorescent probes to sample, identify, and quantify real-time ROS in indoor air. This method makes it possible to study how chemical aging of secondhand smoke, in particular oxidation processes by sunlight and ozone, influences human exposure to secondhand smoke and ROS.

Dr. Sleiman's studies using these probes showed that chemical aging of secondhand smoke particles could lead to increased toxicity. Results from these studies advanced current understandings of the adverse health effects of secondhand smoke exposure and helped establish methods to detect thirdhand smoke and its constituents. This research led to six seminal, highly cited publications, including "Detection and Quantification of Reactive Oxygen Species (ROS) in Indoor Air," published online February 14, 2015, in *Talanta*.¹⁸ To further pursue this area of

¹⁸ [Montesinos VN](#), [Sleiman M](#), [Cohn S](#), [Litter MI](#), [Destailats H](#). Detection and quantification of reactive oxygen species (ROS) in indoor air. [Talanta](#). 2015; Jun 1;138:20-7.

research, Dr. Sleiman received a TRDRP New Investigator Award in 2011 and an Exploratory/Developmental Research Award in 2014.

- Effects of Thirdhand Smoke on Cell and Molecular Mechanisms of Healing

It is well known that tobacco causes cancer and other diseases. Yet, tobacco can also severely affect how people heal. Wounds of smokers and of those exposed to smoking do not close well, potentially remaining as open sores which, with time, can become sites for local infection, spread systemically in the body and become life-threatening. These smoke-related healing problems can affect people of all ages, including children living in the homes of smokers. During wound healing, a variety of processes lead to invasion of the wounded tissue by white blood cells. These cells mount a defensive reaction, provide pathways for incoming blood vessels to heal the wound and contract the wound to help in its final closure. It is known that first-hand smoke and secondhand smoke inhibit this wound healing process.

**TRDRP-funded
research found
significant damage
can occur in the
liver and lung as a
result of exposure
to thirdhand
smoke**

To expand this area of study, Manuela Martins-Green, Ph.D., Professor of Cell Biology, UC Riverside, received a TRDRP Exploratory/Developmental Award in 2010 to study the effects of thirdhand smoke on wound healing. Thirdhand smoke is composed of the toxins that are released by secondhand smoke and accumulate on surfaces such as car seats, dashboards, upholstery, curtains and carpets. Dr. Martins-Green's research found significant damage can occur in the liver and lung as a result of exposure to thirdhand smoke. It also found that thirdhand smoke prolongs wound healing and causes behavioral hyperactivity. These findings were published on October 14, 2014, in *PLoS One* in conjunction with an oral presentation by Dr. Martins-Green at the annual meeting of the Society for Research on Nicotine and Tobacco and received widespread media coverage.¹⁹ To further pursue her research on the effects of thirdhand smoke toxins, Dr. Martins-Green received a TRDRP Research Project Award in 2013.

Industry Influence/Policy

The tobacco industry influences policy at the state, county and city levels. Research is needed on potential policy interventions that could decrease tobacco industry marketing and sales, decrease exposure to secondhand and thirdhand smoke, and reduce children's exposure to cigarette marketing. Cigarette waste is another area of concern. Cigarette waste remains the most common form of litter on U.S. roadways and beaches, making cigarette butt clean-up a substantial cost to communities throughout the state. Nearly all cigarette filters are made of cellulose acetate, a non-biodegradable plastic that remains in the environment for a very long time. Ingested cigarettes are poisonous to children and adults as well as animals, and the chemicals that leach out of cigarette butts are toxic to marine and freshwater fish. TRDRP-funded research in this priority area investigated the tobacco industry's retail practices and methods for reducing secondhand and thirdhand smoke exposure, with the aim of informing sound policies. Three of the grants awarded in this area were:

¹⁹ Martins-Green M, Adhami N, Frankos M, Valdez M, Goodwin B, et al. Cigarette smoke toxins deposited on surfaces: implications for human health. *PLoS ONE*. 2014; 9(1): e86391.

- Modeling and Mapping Changes in Tobacco Outlet Density

Ads and promotions for cigarettes in retail outlets are among the most important ways the tobacco industry maintains its commercial influence in California. Questions have been raised about the relationship between this commercial influence as seen by the relatively higher concentration of tobacco outlets in areas characterized by social and economic disadvantage and disparities in tobacco use, with higher than average rates seen in communities of color, including African-American youth. Lisa Henriksen, Ph.D., Senior Research Scientist, Department of Medicine, Stanford University, investigated changes in the concentration and composition of tobacco outlets, examined which neighborhood demographics are associated with increases in tobacco outlet density, and mapped areas with higher than expected increases.

Dr. Henriksen discussed her findings at a legislative briefing in April 2012. As she reported, her research found that for each 10 percentage point increase in proportion of African-American high school students, the proportion of menthol ads increased 5.9 points; the odds of a Newport (menthol cigarette brand) discount was 1.5 times greater; and the cost per cigarette pack was 12 cents less.²⁰ African-American youth also had greater brand awareness, which was found to be a predictor of likelihood of smoking initiation among African-American youth. This finding contributes to our understanding of how neighborhood characteristics shape tobacco use and, by extension, how changes to the retail environment in a neighborhood might reduce disparities in tobacco use and tobacco-related disease. Such changes could include potential policy interventions, such as zoning ordinances and the establishment of local retailer licensing laws that would limit the minimum distance between tobacco outlets or prohibit tobacco sales along certain avenues of access to schools that are designated as “safe routes” for youth.

TRDRP-funded research found that for each 10 percentage point increase in the proportion of African-American high school students, the proportion of nearby menthol ads increased almost 6 percentage points and the cost per cigarette pack was 12 cents less.

- Certifying Smoke-Free Used Cars: Effects on Value and Consumers

Cars are emerging as sanctuaries for smokers who encounter stricter smoking bans in public places and have adopted smoking bans at home. The small, enclosed cabins of cars are environments for potential secondhand smoke exposure. Car cabins are also particularly susceptible to becoming reservoirs of thirdhand smoke that has gathered on the surface of or become trapped in available materials. This makes the private used car market of particular significance to tobacco control efforts. Georg Matt, Ph.D., M.A., Professor of Psychology, San Diego State University Research Foundation, received a TRDRP Research Project Award in 2012 to investigate whether a smoke-free certification program for used cars sold in the San Diego area would help consumers make informed decisions about purchasing a car free of tobacco smoke pollutants, affect purchasing prices, create a financial incentive in support of

²⁰ Henriksen L, Schleicher NC, Dauphinee AL, Fortmann SP. Targeted advertising, promotion, and price for menthol cigarettes in California high school neighborhoods. *Nicotine Tob Res.* 2012;14(1):116-121.

smoking bans in cars, and contribute to reducing tobacco use and increasing smoking bans in cars and other private environments. Dr. Matt and his colleagues developed detailed protocols and instruments for prevalence monitoring, car wipe sampling, pre- and post-sale participant interviews, and reporting of test results. Of the 166 cars tested by his research team, 132 passed the inspection and received a certificate and 34 failed. Data is being collected on the impact the certificate has on sale prices. This research will provide information about the feasibility of creating a system for routine certification of cars as smoke-free. The model could also potentially be transferred to other indoor settings where existing public policies currently do not apply, such as private homes, rental cars, hotels, real estate and multi-unit housing, contributing to the denormalization of tobacco use and protecting nonsmokers from exposure to the toxic effects of tobacco smoke and tobacco smoke residue.

- Cigarette Producer Responsibility Project

Cigarette butts are the most common form of litter in the world and are the most prevalent debris item collected from beaches and waterways during the annual International Coastal Cleanups. It has been estimated that one in every three cigarettes smoked is discarded as environmental waste. Extended Producer Responsibility (EPR) is the extension of the responsibility of producers, and all entities involved in the product chain, to reduce the impact of a product and its packaging. Under EPR, the producer, or brand owner, is the one primarily responsible for making design and marketing decisions.²¹ Application of EPR to the tobacco industry represents an innovative wedge policy approach to tobacco control.

A TRDRP Exploratory/Developmental Research Award allowed Thomas E. Novotny, M.D., Ph.D., CEO of the Cigarette Butt Pollution Project, to investigate the feasibility of applying EPR to the tobacco industry. Dr. Novotny commissioned a series of policy, legal and legislative analyses from leading experts in the field and convened two expert group meetings to discuss the findings from these papers. The analyses topics included:

- Overview of EPR and the Tobacco Industry
- Current Regulatory Approaches to Tobacco Butt Waste
- Interaction Between State and Local Policies and FDA
- Litigation to Recover Costs of Tobacco Product Environmental Injuries/Harm and Waste Cleanup
- Tobacco Industry Response
- Economic Models to Assess the Burden of Butt Waste

The findings were also published in public health, environmental, and waste management journals and presented at meetings in these fields. This research has the potential to open new channels for policy research by linking tobacco use to environmental degradation, encouraging regulatory interventions through environmental law, and holding the tobacco industry responsible for resulting harms and requisite waste cleanup cost-recovery and other solutions.

Regulatory Science/New Products

Many new challenges have arisen since the Family Smoking Prevention and Tobacco Act of 2009 granted the U.S. Food and Drug Administration (FDA) the power to require appropriate testing and

²¹ <http://www.calrecycle.ca.gov/epr/Framework/Framework.pdf>

evaluation of tobacco products. Increasingly, nicotine delivery systems are produced in non-tobacco forms. These products require scientific scrutiny to determine their short- and long-term health impact. TRDRP funded research on the toxicity and health effects of these products to educate consumers and inform regulatory policy. One of the grants awarded in this area was:

- Electronic Cigarettes: Are They Safe?

Electronic cigarettes (e-cigarettes) are the newest entry into the cigarette marketplace. These products are often touted as a safe alternative to conventional cigarettes, however the actual safety and biological effects of these products are not known. Meanwhile, many states, including California, have had to address issues such as whether e-cigarettes can be smoked indoors and whether they present health risks that require user education or restriction of sales.

In 2011, Prudence Talbot, Ph.D., Professor, Cell Biology and Neuroscience, UC Riverside, received a TRDRP Exploratory/Developmental Research Award to study the toxicity of e-cigarette cartridge fluid and aerosol using biological assays based on human embryonic stem cells and adult lung cells. This research marked the first time objective toxicity data was collected on the cytotoxicity of e-cigarette fluid and aerosol. Stem cells were used to study the effect of e-cigarettes on prenatal development. Adult lung cells were studied because their response to e-cigarette aerosol is an important indicator of potential pulmonary health problems. Dr. Talbot and her team also identified the chemicals in e-cigarette fluid and aerosol in order to study which specific chemicals produced the effects they observed.

TRDRP-funded researchers collected the first objective data on how e-cigarette fluid and aerosol may be toxic to human cells.

This research provided information relevant to lung and reproductive health. It can potentially aid health care workers advising potential users on the safety of e-cigarettes and help policymakers make decisions regarding regulation of e-cigarettes. As an indicator of the importance of this research, in December 2014, two graduate students who worked with Dr. Talbot were invited by the FDA to participate in a public workshop in Washington, D.C. focusing on the science, packaging, labeling and environmental impact of e-cigarettes on public health. Several hundred people attended the workshop and it was broadcast online. Monique Williams presented research on particles and nanoparticles present in e-cigarette fluid and aerosol, published in 2013 in *PLoSOne*.²² Rachel Behar discussed research on the identification of toxicants in cinnamon-flavored e-cigarettes, published in 2014 in *Toxicology in Vitro*.²³

Financial Tables

The following tables report the TRDRP income and expenditures from July 1, 2010, through June 30, 2015. Costs of the grants awarded in each of research priority area and by fiscal year are shown in

²² Williams M, Villarreal A, Bozhilov K, Lin S, Talbot P. Metal and silicate particles including nanoparticles are present in electronic cigarette cartomizer fluid and aerosol. *PLoS ONE*. 2013 8(3): e57987.

²³ Behar, RZ, Davis B, Wang Y Bahl V, Lin A, Talbot, P. Identification of toxicants in cinnamon-flavored electronic cigarette refill fluids *Toxicology in Vitro*. 2014 28(2):198-208.

Tables 1 and 2. The Proposition 99 income that made these grants possible is shown in Table 3, while Table 4 details the operational expenses incurred.

Table 1: TRDRP Research Projects Funded from July 1, 2010 to June 30, 2015 by Priority Area

PRIORITY AREA	NUMBER OF PROJECTS FUNDED	AMOUNT FUNDED	PERCENT OF DOLLARS FUNDED
Disparities, Prevention, Cessation and Nicotine Dependence	74	\$17,078,153	30%
Early Diagnosis/Pathogenesis	75	\$19,089,932	34%
Environmental Exposure and Toxicology	28	\$11,308,160	20%
Industry Influence /Policy	26	\$6,734,693	12%
Regulatory Science/New Products	7	\$2,036,171	4%
Totals	210	\$56,247,109	100%

Table 2: Project Funding Costs 2010 – 2015, by Fiscal Year

FISCAL YEAR	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	5-YEAR SUMMARY	PENDING GRANTS*
Grant Cycle**	19	20	21	22	23		24
CORE GRANTS AWARDED***	51	44	38	40	29	202	31
<i>Direct Costs</i>	\$9,950,242	\$8,316,747	\$8,111,091	\$7,487,736	\$5,516,074	\$39,381,890	\$7,527,610
<i>Indirect Costs</i>	\$2,601,024	\$1,331,019	\$2,133,732	\$2,383,157	\$1,911,947	\$10,360,879	\$2,417,137
<i>Total Costs</i>	\$12,551,266	\$9,647,766	\$10,244,823	\$9,870,893	\$7,428,021	\$49,742,769	\$9,944,747
SPECIAL INITIATIVES AWARDED	2	4	1	0	1	8	0
<i>Direct Costs</i>	\$150,00	\$3,641,983	\$459,900	-	\$2,057,413	\$6,309,296	-
<i>Indirect Costs</i>	\$0	\$2,457	\$0	-	\$192,587	\$195,044	-
<i>Total Costs</i>	\$150,000	\$3,644,440	\$459,900	-	\$2,250,000	\$6,504,340	-
TOTAL PROJECTS FUNDED	53	48	39	40	30	210	31
<i>Total Direct Costs</i>	\$10,100,242	\$11,958,730	\$8,570,991	\$7,487,736	\$7,573,487	\$45,691,186	\$7,527,610
<i>Total Indirect Costs</i>	\$2,601,024	\$1,333,476	\$2,133,732	\$2,383,157	\$2,104,534	\$10,555,923	\$2,417,137
<i>Total Funds Disbursed</i>	\$12,701,266	\$13,292,206	\$10,704,723	\$9,870,893	\$9,678,021	\$56,247,109	\$9,944,747

* Funding decisions made before 7/1/2015

** Refers to the cohort of grants that were funded in the indicated fiscal year

*** Includes single-investigator grants and collaborative community-based participatory research grants

Table 3: TRDRP Proposition 99 Income, 2010 - 2015

FISCAL YEAR	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	5-YEAR SUMMARY
Total Proposition 99 Allocation	\$12,534,000	\$12,681,000	\$11,115,000	\$11,249,000	\$10,128,000	\$57,707,000

Table 4: Expenditures for Administration and Program Support, 2010 - 2015

FISCAL YEAR	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	5 YEAR SUMMARY
Grant Cycle*	19	20	21	22	23	
Administration	\$442,406	\$400,782	\$421,954	\$446,543	\$553,125	\$2,264,811
% Total Funds	3%	3%	4%	4%	5%	4%
Research Support, Evaluation & Communications	\$739,314	\$1,036,729	\$995,766	\$1,064,486	\$1,161,872	\$4,998,168
% Total Funds	6%	8%	9%	9%	11%	9%

* Refers to the cohort of grants that were funded in the indicated fiscal year

IV. Dissemination Activities and Funding Partnerships, 2010-2015

The Tobacco-Related Disease Research Program (TRDRP) regularly hosts research conferences, live webcasts, media events, public policy forums, legislative hearings, trainings and workshops. These programs disseminate TRDRP-funded research findings and inform scientists, policy makers, the media and the public of current research related to tobacco control and tobacco-related disease in California. Below, a few of these activities are described in detail.

Research Conference

The California Tobacco Control Program (CTCP) and TRDRP planned and hosted the conference “Linking Tobacco Control Research and Practice for a Healthier California,” in April 2012. The conference, the first joint meeting of TRDRP investigators and CTCP project directors, strengthened the collaborative efforts to address the rapidly evolving science and practice of tobacco control. Attendees learned about recent scientific advances in tobacco-related research and explored tobacco control’s programmatic successes. Speakers included:

- David Ashley, Ph.D., Director of the Office of Science, U.S. Food and Drug Administration Center for Tobacco Products
- Lisa Henriksen, Ph.D., Senior Research Scientist, Stanford Prevention Research Center, Stanford University School of Medicine
- John Maa, M.D., Assistant Professor of Surgery, University of California, San Francisco
- Gene Matthews, J.D., Senior Fellow, North Carolina Institute for Public Health, University of North Carolina Gillings School of Global Public Health
- Thomas Novotny, M.D., M.P.H., Professor of Epidemiology and Co-director Joint Degree Program in Global Health, California State University, San Diego
- Michael Ong, M.D., Ph.D., Assistant Professor in Residence, Division of General Internal Medicine and Health Services Research, Department of Medicine, University of California, Los Angeles
- Edison Trickett, Ph.D., Community & Prevention Division Chairperson and Professor of Psychology, University of Chicago
- Adewale Troutman, M.D., M.P.H., Consultant on Health Equity and Social Justice, The Troutman Group

The three-day conference included seven scientific breakout sessions consisting of 24 oral presentations, a young investigator session, the introduction of two new statewide tobacco control campaigns, eight tobacco control program workshops consisting of 32 oral presentations along four program tracks and three poster sessions featuring more than 100 scientific and program poster presentations. Attendees discussed:

- new tobacco products and nicotine addiction,
- the role of medical professionals as tobacco cessation advocates,
- secondhand smoke and multi-unit housing,
- evidence-based practice for two new statewide campaigns addressing the retail environment and tobacco waste,
- social determinants of health on tobacco use,
- how the tobacco industry influences tobacco control policy efforts, and
- State and local tobacco control achievements.

The majority of participants who completed the conference evaluation rated the program “excellent” or “good” and found the conference “very useful” or “useful” for their tobacco-related work or disease research. Attendees said they appreciated how the conference bridged the gap between research and practice of tobacco control, allowed for networking and cross collaboration among constituents, and integrated research, policy, and advocacy.

Live Webcasts

The TRDRP produced two live webcasts during the past five years.

The first webcast “Electronic Cigarettes: The vapor this time?” was presented in October 2013. It provided a unique opportunity for scientists, policymakers, and the public to hear the perspectives of presenters on both sides of the debate over the safety of e-cigarettes and their role in tobacco cessation.

The webcast included presentations by:

- Philip Gardiner, Dr.P.H., TRDRP Policy and Regulatory Sciences/Neurosciences and Nicotine Dependence Program Officer, who discussed the emerging debate surrounding e-cigarettes within the context of the overall tobacco control movement;
- Monique Williams, Graduate Student, UC Riverside Environmental Toxicology Department, who presented research on the toxicology of e-cigarette cartridge fluid and inhaled and exhaled aerosol;
- Prudence Talbot, Ph.D., Director of the UC Riverside Stem Cell Center and Stem Cell Core Facility, on the personal and public health effects of e-cigarettes;
- Natalie Walker, Ph.D., Leader of the Addiction Research Program, National Institute for Health Innovation, University of Auckland, New Zealand, on the use of e-cigarettes for smoking cessation;
- Jean-François Etter, Ph.D., Professor of Public Health and Faculty of Medicine, University of Geneva, Switzerland, who discussed vapor and e-cigarette regulation in Europe; and
- Stanton Glantz, Ph.D., Professor of Medicine and the American Legacy Foundation Distinguished Professor of Tobacco Control, Center for Tobacco Control Research & Education, UCSF, who connected the panelists’ presentations to the future of e-cigarette regulation.

The TRDRP webcast provided a unique opportunity for scientists, policymakers and the public to hear the perspectives on both sides of the debate over the safety of e-cigarettes and their role in tobacco cessation.

The majority of participants who completed evaluations indicated that the webcast helped advance their understanding of e-cigarettes and increased their scientific understanding of the chemical composition of e-cigarette vapor and e-cigarette fluid.

The second webcast “Varenicline: Where are we today?” was presented in September 2012. It explored the ongoing controversy within the scientific community over the safety, harmfulness, and usefulness of varenicline (Chantix), a smoking cessation medication the FDA approved in 2006. Scientific studies support the efficacy of varenicline. However, a special black box warning was added to the medication in 2009 after adverse events reports were submitted to the FDA highlighting cardiovascular and psychiatric side effects. The scientific community disagrees on the safety, harmfulness, and usefulness of varenicline as a quit smoking aid.

The webcast allowed physicians, policy makers, and the public to hear leading scientists’ perspectives on the key scientific issues fueling the ongoing controversy. It included presentations by:

- Neal Benowitz, M.D., Professor, School of Medicine, UCSF, on the pharmacology, metabolism and neurology of varenicline;
- Eden Evins, M.D., M.P.H., Professor of Psychiatry, Harvard University and Director of the MGH Center for Addiction Medicine, who discussed the clinical literature on psychiatric co-morbidities associated with varenicline;
- Sonal Singh, M.D., M.P.H., Assistant Professor, School of Medicine, Johns Hopkins University, who explained the benefits and risks of using varenicline for smoking cessation; and
- Judith Prochaska, Ph.D., M.P.H., Associate Professor of Medicine, Stanford University, who also discussed research on varenicline.

The majority of participants who completed evaluations indicated they were “very satisfied” or “satisfied” with the webcast and reported that the information “significantly increased” or “increased” their understanding of the pharmacology of varenicline and its associated adverse psychiatric and cardiovascular events.

Media Events

Media events offer an important opportunity for TRDRP to disseminate research findings. TRDRP partnered with the Los Angeles County Tobacco Control and Prevention Program to hold a press conference in October 2014 to announce findings from the report “The Cost of Smoking in California, 2009,” which details the financial impact of smoking in each of California’s 58 counties. Developed by researchers at the Institute for Health & Aging at the UCSF School of Nursing and funded by the TRDRP, the report is the third in a series by this research group documenting the county-by-county and statewide costs incurred from smoking tobacco products. As in the 1989 and 1999 reports, the costs are calculated from a combination of factors such as healthcare costs and loss of productivity.

The press conference resulted in media coverage by more than 20 media outlets throughout the state, encompassing TV, radio, print and web formats. This included the *San Francisco Chronicle*, *East County Today*, *MedicalXpress.com*, *Appeal-Democrat*, *KPBS-FM*, and *KHSL*.

To ensure continued availability of this information, the “Cost of Smoking” report is highlighted and accessible on the TRDRP website.

Public Policy Forum

The TRDRP hosted the public policy forum “E-Cigarettes: Informing Tax Policy Research in California” in January 2015. At the time the meeting was held, 24 states were considering e-cigarette

taxation bills; two states, Minnesota and North Carolina, had adopted e-cigarette taxation measures; and one city, Petersburg Alaska, had begun taxing e-cigarettes.

The meeting was attended by more than 60 people and included representatives from California and other states, the Federal Centers for Disease Control and Prevention and health voluntaries. Also in attendance were tobacco control advocates, TRDRP-funded researchers and representatives of California's priority populations.

Speakers included:

- Mark Meaney, Staff Attorney, Tobacco Control Legal Consortium, Public Health Law Center, who presented on "Taxation of E-Cigarettes: Where are We Today?"
- Frank Chaloupka, Ph.D., Professor, University of Illinois at Chicago, who presented on "Taxing E-Cigarettes—Options and Potential Public Health Impact"
- Bill Kimsey, Administrator, Special Taxes Appeals Branch, California State Board Equalization, who presented on "E-Cigarette Tax Policy in California"
- Molly Moilanen, Director of Public Affairs, Clearway, Minnesota, who presented on "Taxation of E-Cigarettes in Minnesota"
- Wendy Max, Ph.D., Professor of Health Economics and Co-Director of the Institute for Health & Aging, UCSF, who presented on "Taxing E-Cigarettes: What Research is Needed?"
- Lisa Henriksen, Ph.D., Senior Research Scientist, Stanford Prevention Research Center, Stanford University School of Medicine, who presented on "More Research Gaps for an E-Cigarette Tax: A Communication Research Perspective."

The meeting provided key tobacco research and tobacco control stakeholders in California an opportunity to explore issues surrounding the regulation and taxation of e-cigarettes at the state level and review the current status of e-cigarette taxation, both domestically and internationally. Attendees identified research needs surrounding potential e-cigarette taxation in California.

Legislative Briefings

The TRDRP held two legislative briefings in 2012:

The first briefing, held in May 2012 was: Saving Lives, Saving Money: The Importance of Tobacco Control and Research in California. This briefing was held in collaboration with the American Lung Association, the American Heart Association, and the American Cancer Society. It provided educational information on proposed plans to raise the cigarette tax. Speakers included:

- Michael Ong, M.D., Ph.D., Associate Professor, Department of Medicine, UCLA, who discussed the TERO 2012–2014 Master Plan;
- Wendy Max, Ph.D., Professor of Health Economics and Co-Director of the Institute for Health & Aging at UCSF, who presented findings from TRDRP-funded research on the impact of a cigarette tax; and
- James M. Lightwood, Ph.D., Associate Professor, UCSF School of Pharmacy, who presented findings from TRDRP-supported research on the impact of a cigarette tax.

Drs. Max and Lightwood both reported research that showed raising the cigarette tax in California would save both lives and billions of dollars.

The second briefing, held in April 2012, was: Predatory Marketing by the Tobacco Industry — Luring our Children to Addiction. TRDRP-funded research shows the tobacco industry continues to target children, especially those in African-American neighborhoods. At this briefing, investigators presented their findings. Speakers included:

- Michael Ong, M.D.,Ph.D., Associate Professor, Department of Medicine, University of California, Los Angeles
- Lisa Henriksen, Ph.D., Senior Research Scientist, Stanford Prevention Research Center, Stanford University School of Medicine
- Robert Lipton, Associate Professor, University of Michigan
- Carol McGruder, Co-chair, African American Tobacco Control Leadership Council

TRDRP-funded research shows the tobacco industry continues to target children, especially those in African-American neighborhoods.

Trainings & Workshops

The TRDRP develops and implements activities aimed at strengthening and supporting tobacco-related community-based participatory research. Over the past three years, two trainings and workshops were designed specifically for researchers interested in this area.

In February 2014, TRDRP staff conducted a training and mock review panel for Community Academic Research Award (CARA) and School Academic Research Award (SARA) applicants. These awards aim to stimulate and support collaborations between community-based organizations/schools and academic investigators. The impetus for this training was a similar training TRDRP conducted in 2011 that resulted in a 23 percent higher funding rate for CARA/SARA applications.

Twenty-seven individuals attended the 2014 training representing nine distinct community/academic or school research teams. Following the training, thirteen CARA and SARA proposals were submitted to the program by the April 2014 deadline.

As part of strengthening the coordination between Proposition 99 agencies, TRDRP staff organized and participated in a teleconference in July 2013 for 50-60 Local Lead Agency representatives. The primary goal of the meeting was to encourage tobacco control community program planners funded by the California Tobacco Control Program to consider partnering with researchers to do program evaluations of existing community programs. Cross-sector collaborations that evaluate existing community-based tobacco control programs are important because they have the potential to boost their impact and identify measurable benefits. During the teleconference, TRDRP staff described ways local programs could collaborate with evaluators to submit TRDRP funding proposals and also solicited suggestions about potential research areas that might benefit tobacco control programs and local communities. This effort resulted in at least two TRDRP-funded projects.

Funding Partnerships

The TRDRP partners with external organizations to cooperatively fund research in areas of mutual interest and to extend and amplify the impact of Prop 99 funds. TRDRP partnerships involve:

- **School-Academic Research Awards (SARA)**
The California Department of Education Tobacco-Use Prevention and Education (TUPE) Program and TRDRP partner to fund the SARA grants. These grants support collaborations between schools and university-based investigators to perform scientifically rigorous research in tobacco control issues that are identified as important to schools in the state; are likely to produce results that are meaningful to school-based prevention and intervention efforts; and use methods that are relevant, culturally appropriate, and appropriate in terms defined and accepted by the schools. Schools can be public or private elementary, middle and high schools, continuation high schools, alternative, juvenile court or community schools.
- **California Cancer Research Tax Check Off Fund**
California State Tax Checkoff funds are voluntary donations designated by taxpayers on their state income tax forms. On behalf of the University of California, the TRDRP currently administers the [California Cancer Research Fund](#). Through this tax checkoff fund, TRDRP received a total of \$2,219,582 from July 1, 2010, through June 30, 2015. During the TRDRP 2010 strategic planning process, a broadly representative expert advisory committee recommended that these funds support research in lung cancer and, in particular, its relation to early detection in disproportionately impacted communities in California. Although the TRDRP received these checkoff funds annually, the grants were awarded on a bi-annual basis. Calls for applications for grants from this fund were released in 2011, 2013, and 2015. The proposals submitted underwent the same rigorous scientific review as other TRDRP awards.

The projects supported by California Cancer Research Tax Check Off Funds were:

Grants Awarded in 2011

Rod Lew, M.P.H.

Executive Director

Asian Pacific Partners for Empowerment, Advocacy and Leadership (APPEAL)

Alliance for Data Dissemination to Achieve Equity (ADEPT)

Grants Awarded in 2013

Michael McNitt-Gray, Ph.D.

Professor of Radiology, Thoracic Imaging Section

University of California, Los Angeles

Ultra Low Dose, Effective CT for Lung Cancer Screening

Lori Sakoda, M.P.H., Ph.D.

Research Scientist

Kaiser Permanente Northern California Division of Research

Shared Genetics of COPD and Lung Cancer

Pending Grants (Approved for Funding Prior to 7/1/2015)

Dian Yang
Graduate Student
Stanford University
Genomic Approaches to Identify SCLC Biomarkers

Xiaohe Liu, Ph.D., M.D.
Research Scientist, Discovery Technologies Program
SRI International
CTCs for Early Detection and Characterization of Lung Cancer

Celia Kaplan, Dr. P.H.
Professor of Medicine
University of California, San Francisco
Lung Cancer Screening: The Views of Patients and Physicians

V. Looking Forward

Moving into the 21st century, the Tobacco Related Disease Research Program (TRDRP) has a strong history of significant contributions to tobacco-related biomedical research, intervention development and tobacco control policy in California. During the time period covered by this report, TRDRP's engagement with a strong network of stakeholders allowed it to identify the state's most pressing needs and to respond with timely, innovative research that has informed tobacco control policy and practice. TRDRP-funded research also advanced new and exciting areas of science in tobacco-related diseases, resulting in numerous publications that have positively affected multiple research fields.

The TRDRP has extensive experience addressing the ever-changing landscape of tobacco products, the evolving regulatory environment and new advances in biomedical research. By continually updating its program's priorities and strategies, the TRDRP ensures its resources are strategically and efficiently invested.

In recognition of its commitment to maintaining a leadership role in this arena, on July 1, 2015, the TRDRP and its Scientific Advisory Committee determined it would further strengthen the program's funded research by prioritizing:

TRDRP continues to update its priorities and strategies to address the ever-changing landscape of tobacco products and new advances in biomedical research

- Research with highest potential for impact
 - All applications will be separately and systematically evaluated for the potential of the proposed research to impact the research field and/or California-specific issues related to communities, or state and local policies related to tobacco use and control.
- Research advancing engagement with communities throughout California
 - TRDRP will develop new collaborative community impact funding opportunities while also more fully integrating community engagement and community participation into all award mechanisms at a level appropriate to the type of research.
- Support for developing new leadership in tobacco-related research
 - TRDRP will focus career development awards on the tobacco-related researchers with the highest potential for impact on the field. Toward this end, TRDRP will offer new early and mid-career development and leadership awards.
- Research initiatives targeted at new and emerging challenges in the tobacco landscape
 - In order to address tobacco-related research issues of highest priority to California and the field, TRDRP will release a series of targeted collaborative funding opportunities. Initial opportunities are being developed that will focus on community-level practice impact in priority populations and on the neuroscience and/or cardiopulmonary effects of new tobacco products.

The program and its Scientific Advisory Committee anticipate that these new emphases and initiatives will have broad impact on the field in the years to come and look forward to reporting on its progress in the 2020 Legislative Report.

Appendix I: TRDRP Staff and Scientific Advisory Committee Members

The Legislature, Proposition 99 and Health and Safety Code Section 104500-104545 mandate the structure and staffing of the Tobacco-Related Disease Research Program, which is modeled after the National Institutes of Health. During the period covered by this report, TRDRP staff has included a program director, three to four program officers, and a project policy analyst. The TRDRP program director and program officers all hold doctoral degrees and have extensive training in the specific scientific areas they administer.

Proposition 99 also mandated the development of a Scientific Advisory Committee that would serve as the primary program advisory board for the TRDRP. Members of the Scientific Advisory Committee advise the University of California on the direction and priorities of the TRDRP. They also make funding recommendations for each cycle of peer-reviewed funded grants. Scientific Advisory Committee members represent research institutions and scientific fields involved in tobacco-related disease research and major California organizations involved in tobacco control efforts.

Current members, for example, are affiliated with the University of Southern California, San Diego State University, several University of California campuses, the American Heart Association, the American Cancer Society, the American Lung Association of California, the California Department of Education, the Lung Cancer Alliance and the California Department of Public Health. Each member serves a three-year term without compensation and agrees to refrain from seeking TRDRP funding during tenure on the committee. The TRDRP Scientific Advisory Committee also facilitates collaboration with other relevant agencies and organizations, including the California Department of Public Health and the California Department of Education. These collaborations help coordinate tobacco control activities of local health departments, community non-profit organizations, and statewide training and technical assistance projects.

Current Staff

Bart Aoki, Ph.D.
Director

Phillip Gardiner, Dr.P.H. (semi-retired)
Program Officer for Policy and Regulatory Sciences

Norval Hickman, Ph.D., M.P.H.
Program Officer for Social, Behavioral, Public Health and Policy Sciences

Jennifer V. Jackson
Project Policy Analyst

Anwer Mujeeb, M.Sc., Ph.D.
Program Officer for Biomedical and Environmental Sciences

Tracy Richmond-McKnight, Ph.D.
Program Officer for Cancer and Neuroscience

Prior Staff Members 2010 - 2015

Kamlesh Asotra, Ph.D.

Program Officer for Biomedical Sciences

M.F. Bowen, Ph.D.

Program Officer for Biomedical Sciences

Jewel Charles

Program Specialist

Current Scientific Advisory Board Members

John Maa, M.D., Chair
Marin General Hospital
President, Northern California Chapter of the American College of Surgeons
Board of Directors, American Heart Association, San Francisco Division
Representing: American Heart Association
Term: 2011-2015

Mimi C. Yu, Ph.D.
Co-Chair
Professor (retired)
University of Southern California
Representing: American Cancer Society
Term: 2011-2015

Matthew Brenner, M.D.
Professor of Medicine, Department of Medicine
University of California, Irvine
Representing: Biomedical Research
Term: 2012-2017

Serena Chen, B.A., M.S.
Director of Policy & Tobacco Programs, Greater Bay Area
American Lung Association in California
Representing: American Lung Association in California
Term: 2009-2016

Sean David, M.D., S.M., D.Phil.
Clinical Associate Professor, General Internal Medicine
Stanford University
Representing: Independent Research University
Term: 2012-2015

Jerold A. Last, Ph.D.
Distinguished Professor, Pulmonary and Critical Care Medicine
University of California, Davis
Representing: Environmental Sciences
Term: 2015-2018

Jesse N. Nodora, Dr.P.H.
Assistant Professor, Department of Family and Preventive Medicine
University of California, San Diego
Moores Cancer Center
Representing: Social Behavioral Sciences
Term: 2014-2017

Sarah A. Planche, M.Ed.
School Health Education Consultant
Tobacco Use Prevention and Education Program
California Department of Education
Representing: California Department of Education
Term: 2015-2018

Dan J. Raz, M.D., M.A.S.
Assistant Professor
Surgical Director, Lung Cancer and Thoracic Oncology
City of Hope National Medical Center, Duarte
Representing: Lung Cancer Alliance
Term: 2013-2016

Audrey Smith, M.A., R.D., C.D.E.
Director, Preventive Health Services
Watts Healthcare Corporation, Los Angeles
Representing: Community-Based Provider
Term: 2013-2016

Stephen C. Welter, Ph.D.
Vice President, Research and Graduate Dean
San Diego State University
Representing: Tobacco-Related Disease Research Institute
Term: 2014-2017

Xueying Zhang, M.S.
Research Scientist
California Tobacco Control Program
California Department of Public Health
Representing: California Department of Public Health
Term: 2015-2018

Term Ending 2015

Lawrence Green, Dr.P.H.
Adjunct Professor, Department of Epidemiology and Biostatistics
University of California, San Francisco
Representing: Ex-Officio (TEROC)
Term: 2011-2015

Tom Herman, M.P.A.
Administrator, Coordinated School Health and Safety Office
California Department of Education
Representing: California Department of Education
Term: 2014-2015

Jonathon Isler, Ph.D.
Chief, Evaluation and Knowledge Management Section
California Tobacco Control Program
California Department of Public Health
Representing: California Department of Public Health
Term: 2014-2015

Robert H. Rice, Ph.D.
Professor, Department of Environmental Toxicology
University of California, Davis
Representing: Environmental Sciences
Term: 2012-2015

Term Ending 2014

Marilyn Newhoff, Ph.D.
Dean, College of Health and Human Services
San Diego State University
Representing: Tobacco-Related Disease Research Institute
Term: 2007-2014

Elizabeth (Libby) Smith, Ph.D.
Associate Adjunct Professor, Social and Behavioral Sciences
University of California, San Francisco
Representing: Public Policy Research
Term: 2011-2014

Colleen Stevens, M.S.W.
Branch Chief, Tobacco Control Program
California Department of Public Health
Representing: California Department of Public Health
Term: 2012-2014

Gregory A. Talavera, M.D., M.P.H.
Professor, Graduate School of Public Health
Division of Health Promotion and Behavioral Sciences
San Diego State University
Representing: Social Behavioral Science
Term: 2011-2014

Greg Wolfe
School Health Education Consultant
Tobacco Use Prevention and Education Program
California Department of Education
Representing: California Department of Education
Term: 2012-2014

Linda P. Sarna, DNSc, RN, FAAN
Associate Professor, School of Nursing
University of California, Los Angeles
Representing: Professional Health Organization
Term: 2011-2014

Term Ending 2013

None

Term Ending 2012

Statice Wilmore, B.S.
Tobacco Control Program Coordinator II
City of Pasadena Public Health Department
Health Promotion & Policy Development Division
Representing: Community-Based Provider
Term: 2009-2012

Sara Courtneidge, Ph.D.
Professor
The Burnham Institute for Medical Research
Representing: Biomedical Research
Term: 2008-2012

David Cowling, Ph.D.
California Department of Public Health
CDIC/California Tobacco Control Program
Representing: California Department of Public Health
Term: 2008-2012

Frederic Grannis, M.D.
Associate Professor and Staff Surgeon
Thoracic Surgery
City of Hope National Medical Center
Representing: Lung Cancer Alliance
Term: 2008-2011

Randall S. Stafford, M.D., Ph.D.
Associate Professor of Medicine
Stanford Prevention Research Center
Stanford University Medical School
Representing: Independent Research University
Term: 2008-2011

Term Ending 2011

Fredric B. Kraemer, M.D.

Professor of Medicine

Division of Endocrinology

Stanford University Medical Center

Representing: American Heart Association (Western States Affiliate)

Term: 2008-2011

Paul Murata, M.D., MSPH

Medical Institute of Little Company of Mary (California Division)

Representing: American Cancer Society

Term: 2008-2011

Geraldine V. Padilla, Ph.D.

Professor and Associate Dean for Research

School of Nursing

University of California, San Francisco

Representing: Professional Medical or Health Organization

Term: 2008-2011

Term Ending 2010

None

Appendix II: Tables of TRDRP Grants Awarded July 1, 2010 to June 30, 2015, by Research Priority Area

Table II(a): Grants Awarded July 1, 2010 to June 30, 2015 under TRDRP Priority: Disparities/Prevention/Cessation/Nicotine Dependence

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Dissertation Awards	2010	HRQoL in Veterans with Chronic PTSD and Tobacco Dependence	Harder, Laura	Alliant International University	\$59,300
Dissertation Awards	2011	Smoking and Post-traumatic Growth Among High Risk Youth	Arpawong, Thalida	University of Southern California	\$57,392
Dissertation Awards	2012	Built Environment and Tobacco Use in Homeless Shelters	Patel, Minal	University of California, Los Angeles	\$59,781
Dissertation Awards	2013	Virtually Smoking: How Adolescents Perceive Smoking Imagery	Forsyth, Susan	University of California, San Francisco	\$64,800
Dissertation Awards	2013	Lynx1 modulation of alpha6 nicotinic receptors	Parker, Rell	California Institute of Technology	\$34,560
Dissertation Awards	2014	Adolescent social networks, smoking, and loneliness	Dyal, Stephanie	University of Southern California	\$64,800
Exploratory /Developmental Award	2010	Using Adultborn Neurons to Combat Nicotine Relapse	Berg, Darwin	University of California, San Diego	\$250,000
Exploratory /Developmental Award	2010	Menthol Cigarette Smokers:nAChR Levels and Treatment Effects	Brody, Arthur	Brentwood Biomedical Research Institute	\$317,525
Exploratory /Developmental Award	2010	Understanding nicotinic receptor subtype specificity	Dougherty, Dennis	California Institute of Technology	\$361,036
Exploratory /Developmental Award	2010	A Family Intervention to Reduce Smoking in Vietnamese Men	Tsoh, Janice	University of California, San Francisco	\$288,421
Exploratory /Developmental Award	2011	Leveraging Adjuvants for Improved Nicotine Vaccines	Janda, Kim	Scripps Research Institute	\$421,413

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Exploratory /Developmental Award	2011	Nicotine Receptor in Nicotine Dependence	Lester, Henry	California Institute of Technology	\$404,642
Exploratory /Developmental Award	2011	Tobacco Cessation Interventions for Mental Health Patients	Myers, Mark	Veterans Medical Research Foundation	\$343,173
Exploratory /Developmental Award	2011	Tobacco-use by LGBTQ youth: prevalence and correlates	Shields, John	Education Training and Research Associates, Inc.	\$304,650
Exploratory /Developmental Award	2012	Virtual Intervention for Lung Cancer Stigma	Cataldo, Janine	University of California, San Francisco	\$219,000
Exploratory /Developmental Award	2012	Improving Tobacco Dependence Treatment in the Addictions	Guydish, Joseph	University of California, San Francisco	\$219,000
Exploratory /Developmental Award	2012	Screening Smokers for Depression Using California's Helpline	Strong, David	University of California, San Diego	\$181,932
Exploratory /Developmental Award	2013	MicroRNA Therapeutics for Nicotine Addiction	Berg, Darwin	University of California, San Diego	\$250,000
Exploratory /Developmental Award	2013	A pilot tobacco control intervention for homeless adults	Vijayaraghavan, Maya	University of California, San Diego	\$250,000
Exploratory /Developmental Award	2014	Menthol Cigarette Smoking & Neuroinflammation	Brody, Arthur	Brentwood Biomedical Research Institute	\$235,010
Exploratory /Developmental Award	2014	Subcellular pharmacokinetics of nicotinic compounds	Lester, Henry	California Institute of Technology	\$316,350
Exploratory /Developmental Award	2014	Treatment Engagement for Outpatient Smokers with Psychiatric	Myers, Mark	Veterans Medical Research Foundation	\$264,417
Exploratory /Developmental Award	2015*	Lung Cancer Screening: The Views of Patients and Physicians	Kaplan, Celia P	University of California, San Francisco	\$249,475

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Exploratory /Developmental Award	2015*	Influence of Hormone Use on Smoking among Transwomen/men	Nemoto, Tooru	Public Health Institute	\$229,635
Exploratory /Developmental Award	2015*	A Comprehensive Investigation of ENDS Use in Adolescents	Rubinstein, Mark	University of California, San Francisco	\$248,845
Exploratory /Developmental Award	2015*	Impact of health reform on smoking and treatment utilization	Young-Wolff, Kelly	Kaiser Foundation Research Institute	\$298,832
Full CARA	2012	Youth-led Tobacco Prevention for Southeast Asian Americans	Lee, Juliet	HBSA, Inc.	\$654,319
Full CARA	2015*	Interactive Mobile Doctor (iMD) for Asian smokers	Huang, Susan; Tsoh, Janice	Asian Health Services; University of California, San Francisco	\$402,406
Full SARA	2012	A Youth Development & Parent Toolkit for Tobacco Education	Halpern-Felsher, Bonnie	University of California, San Francisco	\$235,583
Full SARA	2014	A Youth Development & Parent Toolkit for Tobacco Education	Halpern-Felsher, Bonnie	Stanford University	\$223,417
New Investigator Awards	2010	Neurobiology of Cigarette Craving in Adolescent Smokers	Galvan, Adriana	University of California, Los Angeles	\$266,435
New Investigator Awards	2010	Nicotinic receptor-lynx interactions	Miwa, Julie	California Institute of Technology	\$278,797
New Investigator Awards	2011	Role of mGluR7 in nicotine dependence	Li, Xia	University of California, San Diego	\$270,000
Pilot CARA	2010	Determinants of Tobacco Use Among Young Adult South Asians	Palmer, Paula; Surani, Zul	Claremont Graduate University; Special Service for Groups	\$326,756

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Pilot CARA	2014	Investigating E-cigarette Promotion with Young Journalists	Chopel, Alison	Public Health Institute	\$226,365
Pilot CARA	2013	Peer-Led Smoking Cessation for the Severely Mentally Ill	Bromley, Elizabeth; Corteza, Herman	University of California, Los Angeles	\$266,178
Pilot CARA	2012	Practice-based Intervention for Vietnamese & Korean Patients	Huang, Susan	Asian Health Services	\$270,792
Pilot CARA	2013	Sacramento Taking Action Against Nicotine Dependence	Bankston-Lee, Kimberly; Tong, Elisa	University of California, Davis	\$256,060
Pilot CARA	2010	The Chinese Community Internet Stop Smoking Project	Sun, Angela; Tsoh, Janice	Chinese Community Health Resource Center; University of California, San Francisco	\$293,359
Pilot CARA	2012	Tobacco Treatment for Employable Californians	Prochaska, Judith	Stanford University	\$324,976
Pilot CARA	2010	Youth-led Tobacco Prevention among CA Southeast Asians	Lee, Juliet	HBSA, Inc.	\$205,687
Pilot CARA	2015*	Development of an Afterschool Tobacco Use Prevention Program	Cowgill, Burton Lebowski, Brad	University of California, Los Angeles; BREATHE California of Los Angeles County	\$241,044
Pilot SARA	2014	Developing E-Cigs School-Based Prevention Curricula	Halpern-Felsher, Bonnie; Sachnoff, Ira	Stanford University	\$150,033
Pilot SARA	2011	Novel Strategies for School Based-Tobacco Prevention Effort	Halpern-Felsher, Bonnie	University of California, San Francisco	\$124,933
Postdoctoral Fellowship Awards	2014	Novel modulation of AMPA receptor activity by ly-6 proteins	Sung, Rou-Jia	University of California, San Diego	\$135,040

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Postdoctoral Fellowship Awards	2010	AMPA Receptors and Extinction of Nicotine-Seeking Behavior	Dsouza, Manoranjan	University of California, San Diego	\$135,000
Postdoctoral Fellowship Awards	2010	Cessation and Environmental Smoking among Korean Americans	Huh, Jimi	University of Southern California	\$161,060
Postdoctoral Fellowship Awards	2010	Enhancing Validity of a South Asian Tobacco Survey Module	Mukherjea, Arnab	University of California, San Francisco	\$89,999
Postdoctoral Fellowship Awards	2010	Nicotinic Control of Glutamate Synapse Formation	Wang, Xulong	University of California, San Diego	\$135,000
Postdoctoral Fellowship Awards	2011	The Role of Alpha2 nAChR Subtypes in Nicotine Withdrawal	Lotfipour, Shahradd	University of California, Los Angeles	\$135,000
Postdoctoral Fellowship Awards	2012	Nicotine replacement therapy in pregnancy: friend or foe?	Fernandes, Catarina	University of California, San Diego	\$98,506
Postdoctoral Fellowship Awards	2012	Delivering Smoking Cessation to Young Adults in Bars	Grana, Rachel	University of California, San Francisco	\$84,993
Postdoctoral Fellowship Awards	2012	Novel $\alpha 4\beta 2$ nAChR Modulators for Treating Nicotine Addiction	Kaczanowska, Katarzyna	Scripps Research Institute	\$27,273
Postdoctoral Fellowship Awards	2012	Alpha4beta2 nAChR upregulation in the perofrant pathway	Penton, Rachel	California Institute of Technology	\$26,898
Postdoctoral Fellowship Awards	2012	Effect of mGlu7 receptor manipulation on actions of nicotine	Stoker, Astrid	University of California, San Diego	\$89,777
Postdoctoral Fellowship Awards	2013	Menstrual cycle effects on response inhibition in smoking	Pang, Raina	University of Southern California	\$145,800

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Postdoctoral Fellowship Awards	2013	Nicotine Dependence, Metabolism and Smoke Intake in Blacks	St. Helen, Gideon	University of California, San Francisco	\$87,835
Postdoctoral Fellowship Awards	2013	The role of VTA glutamate afferents in nicotine addiction	Yoo, Ji Hoon	University of California, San Diego	\$145,800
Postdoctoral Fellowship Awards	2013	Exploring media to reduce LGBT tobacco use	Sanders-Jackson, Ashley	Stanford University	\$52,367
Postdoctoral Fellowship Awards	2014	Health Disparities: Tobacco Media and LGBT Tobacco Use	Emory, Kristen	University of California, San Diego	\$145,800
Postdoctoral Fellowship Awards	2014	Effects of varenicline in heavy drinking smokers	Roche, Daniel	University of California, Los Angeles	\$145,800
Research Project Awards	2012	Barriers to Blue-Collar HMO Smoking Cessation Participation	Cunradi, Carol	HBSA, Inc.	\$711,096
Research Project Awards	2012	Non-Nicotine Tobacco Constituents in Reward: Age Effects	Leslie, Frances	University of California, Irvine	\$275,155
Research Project Awards	2012	African American Smoking and Quitting in California	Trinidad, Dennis	Claremont Graduate University	\$382,402
Research Project Awards	2012	Preventing and Reducing Tobacco Use Among Homeless Youth	Tucker, Joan	RAND Corporation	\$887,816
Research Project Awards	2012	Fotonovela to prevent SHS exposure in multiunit housing	Unger, Jennifer	University of Southern California	\$795,088
Research Project Awards	2013	Dissemination of the Rx for Change in Psychiatry Curriculum	Prochaska, Judith	Stanford University	\$30,177

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Research Project Awards	2013	African American Perceptions of Tobacco Denormalization	Antin, Tamar	HBSA, Inc.	\$603,465
Research Project Awards	2013	Health and economic toll of tobacco on CA's LGBT community	Max, Wendy	University of California, San Francisco	\$375,845
Research Project Awards	2013	Economic impact of tobacco taxes on African Americans	Sung, Hai-Yen	University of California, San Francisco	\$467,255
Research Project Awards	2013	A Family-Based Approach To Reduce Smoking in Vietnamese Men	Tsoh, Janice	University of California, San Francisco	\$495,265
Research Project Awards	2013	Developmental Nicotine Exposure and Addiction	Lotfipour, Shahrddad	University of California, Los Angeles	\$451,164
Research Project Awards	2014	Tobacco Use Disparities in Californias Priority Populations	Trinidad, Dennis	Claremont Graduate University	\$489,546
Research Project Awards	2015*	Role of Glutamate/ACh co-release in nicotine addiction	Hnasko, Thomas	University of California, San Diego	\$421,875
Research Project Awards	2015*	Dual Use of Marijuana and Tobacco: Social Media and Youth	Lee, Juliet	HBSA, Inc.	\$534,162
Research Project Awards	2015*	Prevention of relapse in nicotine dependence: role of mGluR7	Li, Xia	University of California, San Diego	\$421,875
Research Project Awards	2015*	The role of PACAP/PAC1 receptor system in nicotine addiction	Lutfy, Kabirullah	Western University of Health Sciences	\$475,272
Research Project Awards	2015*	The Cost of Smoking for CA's Racial/Ethnic Communities	Max, Wendy B	University of California, San Francisco	\$136,533
Research Project Awards	2015*	Using technology to help low-income and Latino smokers quit	Munoz, Ricardo	Palo Alto University, Inc.	\$489,060

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Research Project Awards	2015*	Tobacco Treatment for Employable Californians	Prochaska, Judith	Stanford University	\$557,734
Special Projects	2010	Asian Americans and Pacific Islanders Working Group	Mukherjea, Arnab	University of California, San Francisco	\$800
Special Projects	2010	SRNT Tobacco-Related Health Disparities Committee	Vallone, Donna	American Legacy Foundation	\$5,000
Special Projects	2011	Diversity Travel Scholarship Program	Vallone, Donna	American Legacy Foundation	\$3,303
Special Projects	2012	SRNT TRHD Travel Scholarships	Wheeler, Bruce	Society for Research on Nicotine and Tobacco	\$2,900
Special Projects	2013	Nicotinic Acetylcholine Receptor-Based Therapeutics	Burdetsky, Matt	Caplital Meeting Planning	\$5,000
Special Projects	2013	SRNT TRHD Travel Scholarships	Wheeler, Bruce	Society for Research on Nicotine and Tobacco	\$2,400
Special Projects	2013	African American Tobacco Related Health Disparities	Yerger, Valerie	University of California, San Francisco	\$4,596
Special Projects	2014	Translational Nicotine Research Group	Lotfipour, Shahradd	University of California, Los Angeles	\$5,000

*Pending grants (funding decisions made before 7/1/2015)

Table II(b): Grants awarded July 1, 2010 to June 30, 2015 under TRDRP Priority: Early Diagnosis/Pathogenesis

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
California Research Award	2010	Insulin resistance in smokers undergoing smoking cessation	Friedman, Theodore	Friends Research Institute, Inc., Charles R. Drew University of Medicine & Science	\$684,186
Dissertation Awards	2010	Replication Studies of Minor-Groove DNA Adducts	Andersen, Nisana	University of California, Riverside	\$60,000
Dissertation Awards	2010	Synthesis of the anti-cancer norcembranoid inelegnolide	Horn, Evan	University of California, Irvine	\$59,388
Dissertation Awards	2010	In search of a complement system inhibitor targeting C5aR	Kieslich, Chris	University of California, Riverside	\$60,000
Dissertation Awards	2010	Notch Enhances Shear-Mediated Arteriogenesis in Cerebrum	Kim, Tyson	University of California, San Francisco	\$29,982
Dissertation Awards	2011	De-silencing hypermethylated tumor suppressor genes	Kang, Jeenjoo	California Institute of Technology	\$60,000
Dissertation Awards	2011	A Novel Anti-Cancer Therapy: Inhibition of MUS81-EME1	Mukherjee, Sucheta	University of California, Davis	\$60,000
Dissertation Awards	2011	Study of TSNA Signaling Pathway by Targeted Proteomics	Xiao, Yongsheng	University of California, Riverside	\$60,000
Dissertation Awards	2012	Signaling pathways in tobacco-induced vascular dysfunction	Canto, Isabel	University of California, San Diego	\$59,500
Dissertation Awards	2012	Lung cancer initiation by inflammatory proteins	Grant, Jeanette	University of California, Los Angeles	\$21,207
Dissertation Awards	2013	Cell Motility in Pulmonary Premalignancy	Pagano, Paul	University of California, Los Angeles	\$64,800

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Dissertation Awards	2015	Hookah, Vascular and Endothelial Function in Humans	Rezk-Hanna, Mary	University of California, Los Angeles	\$59,307
Dissertation Awards	2015*	Tobacco sensitive regulation of pro-osteogenic promoters	Sparks, Nicole R	University of California, Riverside	\$63,150
Dissertation Awards	2015*	Genomic approaches to identify SCLC biomarkers	Yang, Dian	Stanford University	\$63,364
Exploratory /Developmental Award	2010	Dynamic Imaging of Sodium Channels in Metastatic Lung Cancer	Du Bois, Justin	Stanford University	\$400,000
Exploratory /Developmental Award	2010	Enhancing mTOR-targeted lung cancer therapy	Lee, Jiing-Dwan	Scripps Research Institute	\$473,879
Exploratory /Developmental Award	2010	Novel Susceptibility Factors in Lung Cancer Evolution	Morrison, Ashby	Stanford University	\$400,000
Exploratory /Developmental Award	2010	SOX-2 knockdown in stem cells prevents lung tumor recurrence	Reisfeld, Ralph	Scripps Research Institute	\$473,879
Exploratory /Developmental Award	2010	Targeted nanodelivery of anti-inflammatory drugs	Schnitzer, Jan	Proteomics Research Institute for Systems Medicine	\$482,749
Exploratory /Developmental Award	2010	Apoptotic cell clearance and Tobacco Induced COPD	Silverman, Gregg	University of California, San Diego	\$56,857
Exploratory /Developmental Award	2010	Fbxo2: a master regulator of lung cancer metastasis?	Spruck, Charles	The Burnham Institute for Medical Research	\$477,500
Exploratory /Developmental Award	2011	Proteomic Mapping of Human Lung Tumor Endothelium	Schnitzer, Jan	Proteomics Research Institute for Systems Medicine	\$487,182
Exploratory /Developmental Award	2011	Genome-wide mapping of smoke-induced DNA damage and mutation	Besaratinia, Ahmad	Beckman Research Institute of the City of Hope	\$80,381
Exploratory /Developmental Award	2011	Effect of Smoking on Vascular Calcification in COPD	Budoff, Matthew	LA Biomedical Research Institute at Harbor-UCLA Medical	\$352,244

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Exploratory /Developmental Award	2011	Sirtuin deacetylase and RAS-dependent cancers	Chen, Wenyong	Beckman Research Institute of the City of Hope	\$420,000
Exploratory /Developmental Award	2011	Lung cancer detection by methylation-preserving PCR	Laird-Offringa, Ite	University of Southern California	\$324,325
Exploratory /Developmental Award	2011	Design of Complement Inhibitors for Cardiovascular Disease	Morikis, Dimitrios	University of California, Riverside	\$250,000
Exploratory /Developmental Award	2011	Role for fibroblasts in the chronic immune response in COPD	Nishimura, Stephen	University of California, San Francisco	\$250,000
Exploratory /Developmental Award	2011	SMART:Sequential Motion Adaptation to Improve Lung Cancer RT	Ruan, Dan	University of California, Los Angeles	\$250,000
Exploratory /Developmental Award	2012	Oxidative Stress/Inflammation in Pulmonary Disease	Balch, William	Scripps Research Institute	\$409,427
Exploratory /Developmental Award	2012	Identifying new markers for diagnosis and treatment of SCLC	Chuang, Pao-Tien	University of California, San Francisco	\$219,000
Exploratory /Developmental Award	2012	TITF1 signature biomarkers for early lung cancer detection	Pollack, Jonathan	Stanford University	\$343,799
Exploratory /Developmental Award	2013	Genome-wide mapping of smoke-induced DNA damage and mutation	Besaratinia, Ahmad	University of Southern California	\$334,652
Exploratory /Developmental Award	2013	Hookah, Sympathetic Nerves, and Coronary Perfusion in Humans	Victor, Ronald	Cedars-Sinai Medical Center	\$337,347
Exploratory /Developmental Award	2014	CTCs for early detection and characterization of lung cancer	Liu, Xiaohe	SRI International	\$351,236

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Integrated Research Project	2011	Integrated multi-omics approach to detect early lung cancer	Kelly, Karen	University of California, Davis	\$744,466
Integrated Research Project	2011	Salivary Biomarkers Development for Detection of Lung Cancer	Wong, David	University of California, Los Angeles	\$777,606
New Investigator Awards	2010	Characterization of Platelet Thromboxane A2 Receptors	Khasawneh, Fadi	Western University of Health Sciences	\$277,422
New Investigator Awards	2010	Effects of Resistance Training on Tobacco-Related CVD Risk	Roberts, Christian	University of California, Los Angeles	\$270,000
New Investigator Awards	2010	Pulmonary Rehabilitation in Sleep Disorders affecting COPD	Soler, Xavier	University of California, San Diego	\$270,000
New Investigator Awards	2010	High resolution imaging & ablation for smoke induced cancer	Zhang, Jun	University of California, Irvine	\$264,219
New Investigator Awards	2010	Multiple Salivary Biomarkers for Lung Cancer Detection	Zhang, Lei	University of California, Los Angeles	\$270,000
New Investigator Awards	2011	New Diagnosis of Bladder Cancer: Smokers Opportunity to Quit	Bassett, Jeffrey	University of California, Los Angeles	\$269,936
New Investigator Awards	2011	Dietary effects on tobacco-related lung cancer	Chen, Danica	University of California, Berkeley	\$270,000
New Investigator Awards	2011	Role of PHLPP1 in Astrocytes and Stroke	Purcell, Nicole	University of California, San Diego	\$300,000
New Investigator Awards	2011	Snail-Dependent Malignant Conversion of Airway Epithelium	Walser, Tonya	University of California, Los Angeles	\$270,000
Postdoctoral Fellowship Awards	2010	Regulation of APC-mediated PAR1 signaling	Dores, Michael	University of California, San Diego	\$135,000
Postdoctoral Fellowship Awards	2010	Reversible Covalent Kinase Inhibitors to Combat Metastasis	Krishnan, Shyam	University of California, San Francisco	\$135,000

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Postdoctoral Fellowship Awards	2010	Smoking-related lung repair and early stage lung cancer	Ooi, Aik	University of California, Los Angeles	\$135,000
Postdoctoral Fellowship Awards	2010	Switching off a lung cancer oncogene using small molecules	Peters, Ulf	University of California, San Francisco	\$135,000
Postdoctoral Fellowship Awards	2010	Oncogenic Activation Mechanisms of Phosphoinositol-3-Kinase	Rumpf, Julia	University of California, San Francisco	\$135,000
Postdoctoral Fellowship Awards	2010	O-GlcNAc Glycosylation in Lung Cancer	Yi, Wen	California Institute of Technology	\$111,397
Postdoctoral Fellowship Awards	2010	Inhibiting lung cancer with DNA-binding polyamides	Hargrove, Amanda	California Institute of Technology	\$44,500
Postdoctoral Fellowship Awards	2011	Epigenetic effects of cigarette smoke on the infant airway	Clay, Candice	University of California, Davis	\$82,569
Postdoctoral Fellowship Awards	2011	Mechanisms of ephrin-B2 signaling mediating vasodilation	Cuervo Grajal, Henar	University of California, San Francisco	\$131,921
Postdoctoral Fellowship Awards	2011	Cigarette smoke and lung injury: mechanism of nSMase2 action	Filosto, Simone	University of California, Davis	\$117,255
Postdoctoral Fellowship Awards	2011	Activation of DDAH for the Treatment of Atherosclerosis	Ghebremariam, Yohannes	Stanford University	\$87,350
Postdoctoral Fellowship Awards	2011	Notch mediated mechanisms of mammalian cerebral angiogenesis	Nielsen, Corinne	University of California, San Francisco	\$104,396
Postdoctoral Fellowship Awards	2011	Delineating mechanisms of endothelial cytoprotection by APC	Soh, Jim Kim	University of California, San Diego	\$65,805
Postdoctoral Fellowship Awards	2011	Gene-modified Stromal Cell Therapy for Lung Cancer	Srivastava, Minu	University of California, Los Angeles	\$60,498

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Postdoctoral Fellowship Awards	2011	Mapping the EphA Receptor Landscape in Lung Cancer	Lisabeth, Erika	The Burnham Institute for Medical Research	\$98,299
Postdoctoral Fellowship Awards	2012	Metabolic stress & cell survival in lung cancer	Hou, Ying Chen	The Burnham Institute for Medical Research	\$89,208
Postdoctoral Fellowship Awards	2012	Novel biomarkers and chemoprevention approaches for SCLC	Jahchan, Nadine	Stanford University	\$135,000
Postdoctoral Fellowship Awards	2013	Chromatin remodellers Brg1 and Baf60c in heart development	Hota, Swetansu	J. David Gladstone Institutes	\$145,800
Postdoctoral Fellowship Awards	2013	Targeting Smyd3 methyltransferase for lung cancer therapy	Mazur, Pawel	Stanford University	\$145,800
Postdoctoral Fellowship Awards	2014	Targeting phospho-MARCKS in smoke-mediated lung cancer	Chen, Ching-Hsien	University of California, Davis	\$145,800
Postdoctoral Fellowship Awards	2014	Detection of tumor DNA in plasma: definitive early diagnosis	Klass, Daniel	Stanford University	\$25,104
Postdoctoral Fellowship Awards	2015*	Cardiotoxicity Study of Tobacco Smoking Using hiPSC-CMs	Li, Yingxin	Stanford University	\$145,800
Postdoctoral Fellowship Awards	2015*	Role of Tobacco-Related Toxicants in Cardiovascular Disease	Watrous, Jeramie	University of California, San Diego	\$145,800
Research Project Awards	2012	Suppression of lung adenocarcinoma by miR-34 microRNAs	He, Lin	University of California, Berkeley	\$459,900
Research Project Awards	2012	Clinical Validation of Salivary Oral Cancer Biomarkers	Wong, David	University of California, Los Angeles	\$521,831
Research Project Awards	2013	Joint roles of ceramide, EGFR/Src in lung injury and cancer	Goldkorn, Tzipora	University of California, Davis	\$467,606
Research Project Awards	2013	Ultra Low Dose, Effective CT for Lung Cancer Screening	McNitt-Gray, Michael	University of California, Los Angeles	\$428,183

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Research Project Awards	2013	Early Detection of Stroke and Cardiovascular Disease Risk	Oda, Michael	Children's Hospital Oakland Research Institute	\$586,770
Research Project Awards	2013	Shared Genetics of COPD and Lung Cancer	Sakoda, Lori	Kaiser Foundation Research Institute	\$561,107
Research Project Awards	2014	Early Diagnosis/Pathogenesis of Tobacco-Related Lung Disease	Balch, William	Scripps Research Institute	\$675,093
Research Project Awards	2014	Genomic Signatures of CVD in Twins Discordant for Smoking	Rana, Brinda	University of California, San Diego	\$445,311
Research Project Awards	2015*	Smoking and Embryonal Tumor Study	Heck, Julia	University of California, Los Angeles	\$436,915
Research Project Awards	2015*	Metabolic consequences of tobacco toxicants	Jain, Mohit	University of California, San Diego	\$421,875
Research Project Awards	2015*	Airway inflammation in the evolution of airway fibrosis	Nishimura, Stephen L	University of California, San Francisco	\$421,875
Research Project Awards	2015*	The Role of CSN6 in Cardiac Muscle and Sudden Cardiac Death	Sheikh, Farah	University of California, San Diego	\$421,875
Research Project Awards	2015*	A novel imaging technology for the early detection of Oral Cancer	St. John, Maie	University of California, Los Angeles	\$421,842
Special Projects	2012	Funding Ovarian Cancer Research in California	Zeidman, Jon	Ovarian Cancer Research Fund	\$236,953
Special Projects	2013	3rd International RB conference	Sage, Julien	Stanford University	\$5,000
California Research Award	2010	Insulin resistance in smokers undergoing smoking cessation	Friedman, Theodore	Friends Research Institute, Inc., Charles R. Drew University of Medicine & Science	\$684,186

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Dissertation Awards	2010	Replication Studies of Minor-Groove DNA Adducts	Andersen, Nisana	University of California, Riverside	\$60,000
Dissertation Awards	2010	Synthesis of the anti-cancer norcembranoid inelegnolide	Horn, Evan	University of California, Irvine	\$59,388
Dissertation Awards	2010	In search of a complement system inhibitor targeting C5aR	Kieslich, Chris	University of California, Riverside	\$60,000
Dissertation Awards	2010	Notch Enhances Shear-Mediated Arteriogenesis in Cerebrum	Kim, Tyson	University of California, San Francisco	\$29,982
Dissertation Awards	2011	De-silencing hypermethylated tumor suppressor genes	Kang, Jeenjoo	California Institute of Technology	\$60,000
Dissertation Awards	2011	A Novel Anti-Cancer Therapy: Inhibition of MUS81-EME1	Mukherjee, Sucheta	University of California, Davis	\$60,000
Dissertation Awards	2011	Study of TSNA Signaling Pathway by Targeted Proteomics	Xiao, Yongsheng	University of California, Riverside	\$60,000
Dissertation Awards	2012	Signaling pathways in tobacco-induced vascular dysfunction	Canto, Isabel	University of California, San Diego	\$59,500
Dissertation Awards	2012	Lung cancer initiation by inflammatory proteins	Grant, Jeanette	University of California, Los Angeles	\$21,207

*Pending grants (funding decisions made before 7/1/2015)

**Table II(c): Grants awarded July 1, 2010 to June 30, 2015 under TRDRP Priority:
Environmental Exposure/Toxicology**

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
California Research Award	2010	Identifying and Measuring SHS in Multi-Unit Dwellings	Hildemann, Lynn	Stanford University	\$762,417
California Research Award	2010	Thirdhand Smoke Pollution and Exposure in Ex-Smokers' Homes	Matt, Georg	San Diego State University Research Foundation	\$769,251
Dissertation Awards	2011	Predicting bone teratogenicity of tobacco products in vitro	Martinez, Ivann	University of California, Riverside	\$59,825
Dissertation Awards	2013	Toxicological Evaluation of Thirdhand Smoke	Bahl, Vasundhra	University of California, Riverside	\$64,800
Dissertation Awards	2014	THS exposure results in Insulin Resistance	Adhami, Neema	University of California, Riverside	\$63,191
Exploratory /Developmental Award	2010	Genotoxicity of Thirdhand Smoke and Aged Secondhand Smoke	Hang, Bo	Lawrence Berkeley National Laboratory	\$427,204
Exploratory /Developmental Award	2010	Effects of THS on cell and molecular mechanisms of healing	Martins-Green, Manuela	University of California, Riverside	\$250,000
Exploratory /Developmental Award	2010	Secondhand Smoke and Human Prenatal Development	Talbot, Prudence	University of California, Riverside	\$280,000
Exploratory /Developmental Award	2012	Imaging SHS Deposition in the Airways of Sprague-Dawley Rats	Wexler, Anthony	University of California, Davis	\$218,999
Exploratory /Developmental Award	2013	Atmospheric transformations of second hand smoke	Hasson, Alam	California State University, Fresno Foundation	\$273,446
Exploratory /Developmental Award	2013	Prenatal Nicotine Exposure and Epigenetic Regulation of AT2R	Xiao, DaLiao	Loma Linda University	\$316,000

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Exploratory /Developmental Award	2014	Indoor vaping: chemical characterization and health impacts	Sleiman, Mohamad	Lawrence Berkeley National Laboratory	\$299,011
Exploratory /Developmental Award	2014	Characterization of emissions from electronic cigarettes	Zhu, Yifang	University of California, Los Angeles	\$230,750
Exploratory /Developmental Award	2015*	Cigarette Butt-derived Pollutants in the Coastal Environment	Gossett, Rich	California State University, Long Beach Foundation	\$200,000
Integrated Research Project	2011	Thirdhand Tobacco Smoke Exposure and Health Risk Assessment	Benowitz, Neal	University of California, San Francisco	\$1,742,462
Integrated Research Project	2014	Impacts of Thirdhand Smoke on Public Health	Benowitz, Neal	University of California, San Francisco	\$2,250,000
New Investigator Awards	2010	Prenatal Toxicity of Traditional and Harm Reduction Tobacco	Zur Nieden, Nicole	University of California, Riverside	\$314,772
New Investigator Awards	2011	Indoor chemistry of secondhand and thirdhand smoke	Sleiman, Mohamad	Lawrence Berkeley National Laboratory	\$271,559
Postdoctoral Fellowship Awards	2011	Identification of Harm Reduction Sidestream Smoke Toxicants	Lin, Sabrina	University of California, Riverside	\$135,000
Postdoctoral Fellowship Awards	2012	Proteomic Assessment of Heavy Metal Mixture Exposure	Prins, John	University of California, Riverside	\$45,000
Postdoctoral Fellowship Awards	2015*	Molecular and Cellular Phenotyping of Second Hand Smoke-Rela	Bauer, Rebecca N	Stanford University	\$145,800
Research Project Awards	2012	Third hand smoke & hypersensitivity	Galli, Stephen	Stanford University	\$669,083
Research Project Awards	2013	Effects of THS toxins on mechanical and drug-induced injury	Martins-Green, Manuela	University of California, Riverside	\$450,896

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Research Project Awards	2013	Toward Smoke-Free Casinos: The Win-River Experience	Matt, Georg	San Diego State University Research Foundation	\$269,209
Research Project Awards	2014	Assessing Toxicity of Tobacco Product Waste to Humans	Hoh, Eunha	San Diego State University Research Foundation	\$536,478
Research Project Awards	2014	Perinatal Tobacco Exposure Epigenetics & Transgenerational	Rehan, Virender	LA Biomedical Research Institute at Harbor-UCLA Medical	\$445,312
Research Project Awards	2015*	Air pollution, tobacco smoke, & asthma in minority children	Burchard, Esteban	University of California, San Francisco	\$419,485
Research Project Awards	2015*	Genotoxicity and Novel Biomarkers of Thirdhand Smoke	Hang, Bo	Lawrence Berkeley National Laboratory	\$648,322
Research Project Awards	2015*	Controlled Thirdhand Smoke Exposure Core	Schick, Suzaynn	University of California, San Francisco	\$304,957
Research Project Awards	2015*	Cytotoxicity and Stress Induction by Thirdhand Smoke	Talbot, Prudence	University of California, Riverside	\$411,053
Special Projects	2010	Second Annual Meeting Tobacco-Related Disease Research at UCR	Talbot, Prudence	University of California, Riverside	\$3,500
Special Projects	2011	Clearing the Air Institute	Hallett, Cynthia	American Nonsmokers' Rights Foundation	\$5,000
Special Projects	2011	Cigarette Butt Advisory Group Meeting 11/2/11	Novotny, Thomas	Cigarette Butt Pollution Project	\$4,995
Special Projects	2012	Cardiovascular Ultrasound Machine for SHS/THS Exposure Core	Schick, Suzaynn	University of California, San Francisco	\$150,000

*Pending grants (funding decisions made before 7/1/2015)

Table II (d): Grants awarded July 1, 2010 to June 30, 2015 under TRDRP Priority: Industry Influence/Policy

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
California Research Award	2010	Retail Access to Tobacco and Youth Smoking Behavior	Lipperman-Kreda, Sharon	HBSA, Inc.	\$816,136
California Research Award	2011	Improving access to Industry and tobacco control resources	Butter, Karen	University of California, San Francisco	\$138,267
California Research Award	2011	The Cost of Smoking for California's 58 Counties	Max, Wendy	University of California, San Francisco	\$379,906
California Research Award	2011	Establishing Smokefree Policy in California Indian Casinos	Moore, Roland	HBSA, Inc.	\$734,794
California Research Award	2011	Evaluating a city's smokefree policy in multi-unit housing	Yerger, Valerie	University of California, San Francisco	\$671,299
Dissertation Awards	2010	Adoption of Tobacco Programs in California Schools	Little, Melissa	University of Southern California	\$47,701
Dissertation Awards	2010	Investigating Tobacco Industry Research on Polonium-210	Rego, Brianna	Stanford University	\$54,504
Dissertation Awards	2015*	The Impact of Trade Agreements on Domestic Health Regulation	Crosbie, Eric	University of California, Santa Cruz	\$30,000
Dissertation Awards	2015*	Predictors of Tobacco Use in Hispanic Americans	Mills, Sarah D	San Diego State University Research Foundation	\$32,274
Exploratory /Developmental Award	2011	The effects of stereotype threat on smoking behavior	Shapiro, Jenessa	University of California, Los Angeles	\$263,932

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Exploratory /Developmental Award	2012	Cigarette Producer Responsibility Project	Novotny, Thomas	Cigarette Butt Pollution Project	\$229,875
Full CARA	2014	Healthy Retail as a Tobacco Control Strategy in SF	Minkler, Meredith; Estrada, Jessica	University of California, Berkeley	\$440,546
Postdoctoral Fellowship Awards	2011	International Health Policy and Tobacco Control in CA	Gonzalez, Mariaelena	University of California, San Francisco	\$84,927
Postdoctoral Fellowship Awards	2013	Adoption and Implementation of Campus Tobacco-free Policies	Fallin, Amanda	University of California, San Francisco	\$41,670
Research Project Awards	2012	Certifying Smoke-Free Used Cars	Matt, Georg	San Diego State University Research Foundation	\$687,545
Research Project Awards	2013	GIS tools for surveillance and regulation of flavored OTPs	Henriksen, Lisa	Stanford University	\$566,132
Research Project Awards	2013	Social media messaging and public health campaigns: Prop 29	Pierce, John	University of California, San Diego	\$290,315
Research Project Awards	2014	ENDS on campus: Changes in policy and retail environments	Henriksen, Lisa	Stanford University	\$530,987
Special Projects	2010	Cost of Smoking II	Glantz, Stanton	University of California, San Francisco	\$112,500
Special Projects	2010	Tobacco Control Laws Preservation Project: Digital Policy	Hallett, Cynthia	American Nonsmokers' Rights Foundation	\$8,285
Special Projects	2010	The Cigarette Butt Pollution Project TC journal supplement	Novotny, Thomas	San Diego State University Research Foundation	\$8,050

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Special Projects	2010	Cost of Smoking II	Pierce, John	University of California, San Diego	\$37,500
Special Projects	2011	Alliance for Data dissemination to Achieve Equity (ADEPT)	Lew, Rod	Asian Pacific Partners for Empowerment Advocacy & Leade	\$481,501
Special Projects	2012	CA Conference on Tobacco Control & Research	Kurtz, Caroline	California Department of Public Health	\$83,482
Special Projects	2012	Clearing the Air Institute	Hallett, Cynthia	American Nonsmokers' Rights Foundation	\$5,000
Special Projects	2012	A Research Agenda to Determine & Counter Big Tobacco	Shaffer, Ellen	Center for Policy Analysis	\$5,000
Special Projects	2013	UC Tobacco Policy Evaluation	Fallin, Amanda	University of California, San Francisco	\$9,839
Special Projects	2014	Conference Support for Clearing the Air September 2014	Hallett, Cynthia	American Nonsmokers' Rights Foundation	\$5,000

*Pending grants (funding decisions made before 7/1/2015)

Table II(e): Grants awarded July 1, 2010 to June 30, 2015 under TRDRP Priority: Regulatory Science/New Products

MECHANISM	YEAR FUNDED	TITLE	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
Dissertation Awards	2015	Evaluation of Metal Emissions in Electronic Cigarettes	Williams, Monique	University of California, Riverside	\$63,191
Exploratory /Developmental Award	2011	Electronic Cigarettes: Are They Safe?	Talbot, Prudence	University of California, Riverside	\$280,000
Exploratory /Developmental Award	2013	An experimental assessment of FDA graphic warning labels	Guydish, Joseph	University of California, San Francisco	\$252,794
Exploratory /Developmental Award	2014	Impact of electronic cigarettes on cardiac risk	Middlekauff, Holly	University of California, Los Angeles	\$264,812
Research Project Awards	2013	Metals and nanoparticles in electronic cigarette aerosol	Talbot, Prudence	University of California, Riverside	\$270,160
Research Project Awards	2014	Biological Impact of E-Cigarettes on Lung Carcinogenesis	Dubinett, Steven	University of California, Los Angeles	\$445,314
Research Project Awards	2012	Tobacco control policy and population-level harm reduction	Messer, Karen	University of California, San Diego	\$459,900
Research Project Awards	2015*	Electronic Nicotine Delivery Systems and California Youth	Antin, Tamar	HBSA, Inc.	\$571,269
Research Project Awards	2015*	Population studies of new tobacco products and cigarettes	Messer, Karen S	University of California, San Diego	\$421,403

*Pending grants (funding decisions made before 7/1/2015)

Table II(f): Cornelius Hopper Diversity Award Supplements (CHDAS) awarded July 1, 2010 to June 30, 2015

MECHANISM	YEAR FUNDED	INVESTIGATOR(S)	INSTITUTION(S)	DOLLARS
CHDAS	2011	Melanie Sabado	Claremont Graduate University	\$16,135
CHDAS	2011	Joanne Chan	Chinese Community Health Resource Center	\$16,200
CHDAS	2011	Joyce Cheng	Chinese Community Health Resource Center	\$16,200
CHDAS	2011	Icarus Tsang	University of California, San Francisco	\$19,607
CHDAS	2011	Anthony Nguyen	University of California, San Francisco	\$19,607
CHDAS	2011	Rachel Behar	University of California, Riverside	\$30,000
CHDAS	2012	Beatriz Rodriques	University of California, Riverside	\$30,000
CHDAS	2012	Nicole Sparks	University of California, Riverside	\$15,000
CHDAS	2012	Zarina Sabrina Abramova	University of Southern California	\$30,000
CHDAS	2012	Amy Taylor	University of California, Riverside	\$30,000
CHDAS	2012	Barbara Davis	University of Southern California	\$30,000
CHDAS	2013	Tiffany Morton	Charles Drew University	\$15,000
CHDAS	2013	Phoenix Jackson	University of California, San Francisco	\$15,000
CHDAS	2013	Iris Guzman	University of California, Los Angeles	\$15,000
CHDAS	2013	My Crystal Hua	University of California, San Francisco / University of California, Riverside	\$30,000
CHDAS	2013	Thomas Duong	University of California, Davis / Asian Health Services	\$17,206
CHDAS	2013	Jinyoung Chung	University of California, Davis / Asian Health Services	\$17,220
CHDAS	2013	Angelica Rendon Delgado	University of Southern California	\$49,287
CHDAS	2013	Sanas Javadian	San Diego State University	\$33,000
CHDAS	2014	Illiana Cordova	University of California, Riverside	\$32,400
CHDAS	2014	Kristine Phung	University of California, San Francisco	\$25,715
CHDAS	2014	Denise Maratos	University of California, Los Angeles	\$16,178
CHDAS	2015*	Beatriz Anguiano	Stanford University	\$16,200
CHDAS	2015*	Zuelma Esquivel	University of California, Los Angeles	\$15,060
CHDAS	2015*	Victor Camberos	University of California, Riverside	\$16,200
CHDAS	2015*	Sarah Hellesten	University of California, Davis	\$16,200
CHDAS	2015*	Kacey Peters	University of California, Los Angeles	\$16,200
CHDAS	2015*	Edgar Yu	University of California, San Francisco	\$16,200
CHDAS	2015*	Lenard Yabes	San Diego State University Research Foundation	\$16,200
CHDAS	2015*	Cristina Flores	University of California, Riverside	\$16,200
CHDAS	2015*	Simon Vu	University of California, San Davis	\$16,200

*Pending grants (funding decisions made before 7/1/2015)

Appendix III: Publications from Thirdhand Smoke Initiative

1. Hoh E, Hunt RN, Quintana PJ, Zakarian JM, Chatfield DA, Wittry BC, Rodriguez E, Matt GE. Environmental tobacco smoke as a source of polycyclic aromatic hydrocarbons in settled household dust. *Environ Sci Technol*. 2012; 46(7): p. 4174-83. 2013
2. Hang B, Sarker AH, Havel C, Saha S, Hazra TK, Schick S, Jacob P III, Rehan VK, Chenna A, Sharan D, Sleiman M, Destailats H, Gundel LA. Thirdhand smoke causes DNA damage in human cells. *Mutagenesis*. 2013;28, 381-391.
3. Jacob P 3rd, Goniewicz ML, Havel C, Schick CF, Benowitz N. Nicotelline: A proposed biomarker and environmental tracer for particulate matter derived from tobacco smoke. *Chem Res Toxicol*. 2013;18;26(11):1615-3.1
4. Matt GE, Fortmann AL, Quintana PJE, Zakarian JM, Romero RA, Chatfield DA, Hoh, E, Hovell MF. Towards smoke-free rental cars: an evaluation of voluntary smoking restrictions in California. *Tob Control*. 2013; 22(3): p. 201-7.
5. Quintana PJ, Matt GE, Chatfield DA, Zakarian JM, Fortmann AL, Hoh E. Wipe sampling for nicotine as a marker of thirdhand tobacco smoke contamination on surfaces in homes, cars, and hotels. *Nicotine Tob Res*. 2013; 15(9): p. 1555-63.
6. Sleiman M, Destailats H, Gundel LA. Solid-phase supported profluorescent nitroxide probe for the determination of aerosol-borne reactive oxygen species. *Talanta*. 2013;116, 1033-1039.
7. Bahl V, Jacob 3rd P, Havel C, Schick SF, Talbot P. Thirdhand cigarette smoke: factors affecting exposure and remediation. *PLOS One*. 2014;9(10): e108258.
8. Klepeis NE, Hughes SC, Edwards RD, Allen T, Johnson M, Chowdhury Z, Smith KR, Boman-Davis M, Bellettiere J, Hovell MF. Promoting smoke-free homes: A novel behavioral intervention using realtime audio-visual feedback on airborne particle levels. *PLoS ONE*. 2014; 8(8) e73251.
9. Martins-Green M, Frankos M, Adhami N, Valdez M, Goodwin B, Lyubovitsky J, Dhall S, Garcia M, Egiebor I, Martinez B, Green HW, Havel C, Yu L, Liles S, Matt G, Destailats H, Sleiman M, Gundel LA, Benowitz N, Jacob 3rd P, Hovell M, Winickoff JP, Curras-Collazo M. Cigarette smoke toxins deposited on surfaces: Implications for human health. *PLoS ONE*. 2014; 9(1): e86391.
10. Sarker AH, Chatterjee A, Williams M, Lin S, Havel C, Jacob 3rd P, Boldogh I, Hazra TK, Talbot P and Hang B. NEIL2 protects against oxidative DNA damage induced by sidestream smoke in human cells. *PLoS ONE*. 2014; Mar 3;9(3):e90261.
11. Matt GE, Quintana PJE, Fortmann AL, Zakarian JM, Galaviz, VE, Chatfield DA, Hoh, E, Hovell MF, Winston C. Thirdhand smoke and exposure in California hotels: non-smoking rooms fail to protect nonsmoking hotel guests from tobacco smoke exposure. *Tob Control*. 2014;23(3): p. 264 - 272.

12. Schick S, Farraro KF, Perrino C, Sleiman M, van de Vossenberg G, Trinh MP, Hammond SK, Jenkins BM, Balmes JR. Thirdhand cigarette smoke in an experimental chamber: evidence of surface deposition of nicotine, nitrosamines and polycyclic aromatic hydrocarbons and de novo formation of NNK. *Tob Control*. 2014; 23(2) 152-158.
13. Sleiman M, Logue JM, Luo W, Pankow JF, Gundel LA, Destailats H. Inhalatory constituents of thirdhand tobacco smoke: Chemical characterization and health impact considerations. *Environ Sci Technol*. 2014. 48;13093-13101.
14. Whitehead TP, Havel C, Metayer C, Benowitz NL, and Jacob 3rd P. Tobacco alkaloids and tobacco-specific nitrosamines in dust from homes of smokeless tobacco users, active smokers and nontobacco users. *Chem Res Toxicol*, 2015.

Additional articles with Consortium investigators as co-authors

15. Apelberg BJ, Hepp LM, Avila-Tang E, Gundel AL, Hammond SK, Hovell MF, Hyland A, Klepeis NE, Madsen C, Navas-Acien A, Repace J, Samet JM, Breyse PN. Environmental monitoring of secondhand smoke exposure. *Tob Control*. 2013; 22(3):147-55.
16. Gundel LA, Destailats H. Aerosol chemistry and physics: An indoor perspective. In *Aerosols Handbook: Measurements, dosimetry and health effects*, 2nd Edition, Editors: L. S. Ruzer and N.H. Harley, CRC Press, Boca Raton, FL 2012.
17. Hovell MF, Lessov-Schlaggar CN, Ding D. Smokefree community policies promote home smoking and unknown mechanisms and opportunities for preventive medicine. *Am J Prev Med*. 2011; 41(6):650-652.
18. Kassem NO, Daffa RM, Liles S, Jackson SR, Kassem NO, Younis MA, Mehta S, Chen M, Jacob P 3rd, Carmella SG, Chatfield DA, Benowitz NL, Matt GE, Hecht SS, Hovell MF. Children's exposure to secondhand and thirdhand smoke carcinogens and toxicants in homes of hookah smokers. *Nicotine Tob Res*. 2014.;16(7):961-75.
19. Pinnameni K, Sievers RE, Sharma R, Selchau AM, Gutierrez G, Nordsiek EJ, Su R, An S, Chen Q, Wan X, Derakhshandeh R, Aschbacher K, Heiss C, Glantz SA, Schick SF, Springer ML. Brief exposure to secondhand smoke reversibly impairs endothelial vasodilatory function. *Nicotine Tob Res*, 2014;16: 584-90.
20. Schick S, van den Vossenberg G, Luo A, Whitlatch A, Jacob III P, Balmes J and Shusterman D (2013). Thirty minute exposure to aged cigarette smoke increases nasal congestion in nonsmokers, *J Toxicol and Environ Health Part A: Current Issues*, 76:10, 601-613.
21. Waldo SW, Brenner DA, McCabe, JM, Dela Cruz M, Long B, Narla VA, Park J, Kulkarn A, Sinclair E, Chan SY, Schick SF, Malik N, Ganz, P, Hsue, PY. A novel, minimally-invasive method to sample human endothelial cells for molecular profiling. *PLOS One*. 2015 in press.

Appendix IV: Media Coverage of Research Results from Thirdhand Smoke Initiative

1. CBS Sacramento: [California Bill Targets Third-Hand Smoke In Home Day Care Centers](http://sacramento.cbslocal.com/2014/04/21/california-bill-targets-third-hand-smoke-in-home-daycare-centers/) (2014.4.21)
<http://sacramento.cbslocal.com/2014/04/21/california-bill-targets-third-hand-smoke-in-home-daycare-centers/>
2. [NY Times article about SDSU's hotel study](http://well.blogs.nytimes.com/2013/05/17/smoke-permeates-nonsmokinghotelrooms/?_php=true&_type=blogs&_r=0) (2013.5.17)
http://well.blogs.nytimes.com/2013/05/17/smoke-permeates-nonsmokinghotelrooms/?_php=true&_type=blogs&_r=0
3. [BBC and USA Today article about SDSU's hotel study](http://www.usatoday.com/story/news/nation/2013/05/13/smoke-free-hotel-rooms/2156013/) (2013.5.13)
<http://www.usatoday.com/story/news/nation/2013/05/13/smoke-free-hotel-rooms/2156013/>
4. Science Daily: [Thirdhand Smoke Causes DNA Damage](http://www.sciencedaily.com/releases/2013/06/130620132459.htm) (2013.6.13)
<http://www.sciencedaily.com/releases/2013/06/130620132459.htm>
5. ABClocal: [Third-hand smoke causes significant DNA damage](http://abclocal.go.com/kabc/story?id=9147350) (2013.6.21)
<http://abclocal.go.com/kabc/story?id=9147350>
6. FOX News: [Thirdhand smoke damages human cells, study says](http://www.foxnews.com/health/2013/06/24/thirdhand-smoke-damages-human-cells/) (2013.6.24)
<http://www.foxnews.com/health/2013/06/24/thirdhand-smoke-damages-human-cells/>
7. China News Service: [Third-hand smoke damages human cells](http://www.chinanews.com/hr/2013/06-27/4975014.shtml) (2013.6.27)
<http://www.chinanews.com/hr/2013/06-27/4975014.shtml>
8. FOX News: [Thirdhand smoke poses cancer risk](http://www.foxnews.com/health/2014/03/17/thirdhand-smoke-poses-cancer-risk) (2014.3.17)
<http://www.foxnews.com/health/2014/03/17/thirdhand-smoke-poses-cancer-risk>
9. National Public Radio: [Scientists search for toxins in cigarette smoke residue](http://www.npr.org/blogs/health/2014/03/17/290858487/) (2014.3.17)
<http://www.npr.org/blogs/health/2014/03/17/290858487/>

Appendix V: Publications from Lung Cancer Early Detection Initiative

Salivary Biomarkers Development for Detection of Lung Cancer (PI: D. Wong)

1. Wong DT. Salivary extracellular noncoding RNA: emerging biomarkers for molecular diagnostics. *Clin Ther*. 2015 Mar 1;37(3):540-51.
2. Tu M, Wei F, Yang J, Wong D. Detection of exosomal biomarker by electric field-induced release and measurement (EFIRM). *J Vis Exp*. 2015; Jan 23;(95):52439.
3. Yang J, Wei F, Schafer C, Wong DT. Detection of tumor cell-specific mRNA and protein in exosome-like microvesicles from blood and saliva. *PLoS One*. 2014 Nov 14;9(11):e110641.
4. Wei F, Lin CC, Joon A, Feng Z, Troche G, Lira ME, Chia D, Mao M, Ho CL, Su WC, Wong DT. Noninvasive saliva-based EGFR gene mutation detection in patients with lung cancer. *Am J Respir Crit Care Med*. 2014 Nov 15;190(10):1117-26.
5. Wei F, Yang J, Wong DT. Detection of exosomal biomarker by electric field-induced release and measurement (EFIRM). *Biosens Bioelectron*. 2013 Jun 15;44:115-21.
6. Zhang L, Xiao H, Zhou H, Santiago S, Lee JM, Garon EB, Yang J, Brinkmann O, Yan X, Akin D, Chia D, Elashoff D, Park NH, Wong DT. Development of transcriptomic biomarker signature in human saliva to detect lung cancer. *Cell Mol Life Sci*. 2012 Oct;69(19):3341-50.

Integrated Multi-omics Approach to Detect Early Lung Cancer (PI: K. Kelly)

1. Fahrman JF, Kim K, DeFelice BC, Taylor SL, Gandara DR, Yoneda KY, Cooke DT, Fiehn O, Kelly K, Miyamoto S. Investigation of Metabolomic Blood Biomarkers for Detection of Adenocarcinoma Lung Cancer. *Cancer Epidemiol Biomarkers Prev* 2015 Aug 17; 24(11); 1716–23.
2. Wikoff WR, Grapov D, Fahrman JF, DeFelice B, Rom WN, Pass HI, Kim K, Nguyen U, Taylor SL, Gandara DR, Kelly K, Fiehn O, Miyamoto S. Metabolomic markers of altered nucleotide metabolism in early stage adenocarcinoma. *Cancer Prev Res(Phila)*. 2015 May;8(5):410-8.